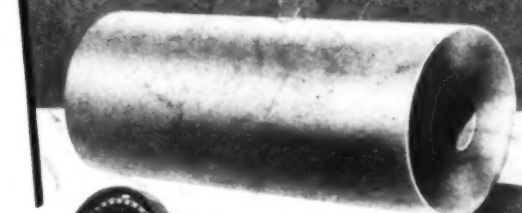
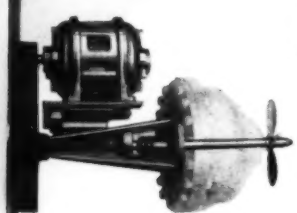
THE PAPER INDUSTRY
and PAPER WORLD
AN EDUCATIONAL NEWS MAGAZINE—FEBRUARY, 1946

PUBLIC LIBRARY
DETROIT

WHERE can dollars be saved in your production line-up





...ask PATTERSON!

SATISFACTION PATTERSON MACHINERY

Patterson Engineering Service brings an invaluable "outside" approach to your manufacturing problems. You'll find a consultation profitable!

Richard L. Cameron
President

THE PATTERSON FOUNDRY & MACHINE CO.
EAST LIVERPOOL, OHIO, U. S. A.
IN CANADA THE PATTERSON FOUNDRY & MACHINE CO. (CANADA) Ltd., London, Ontario

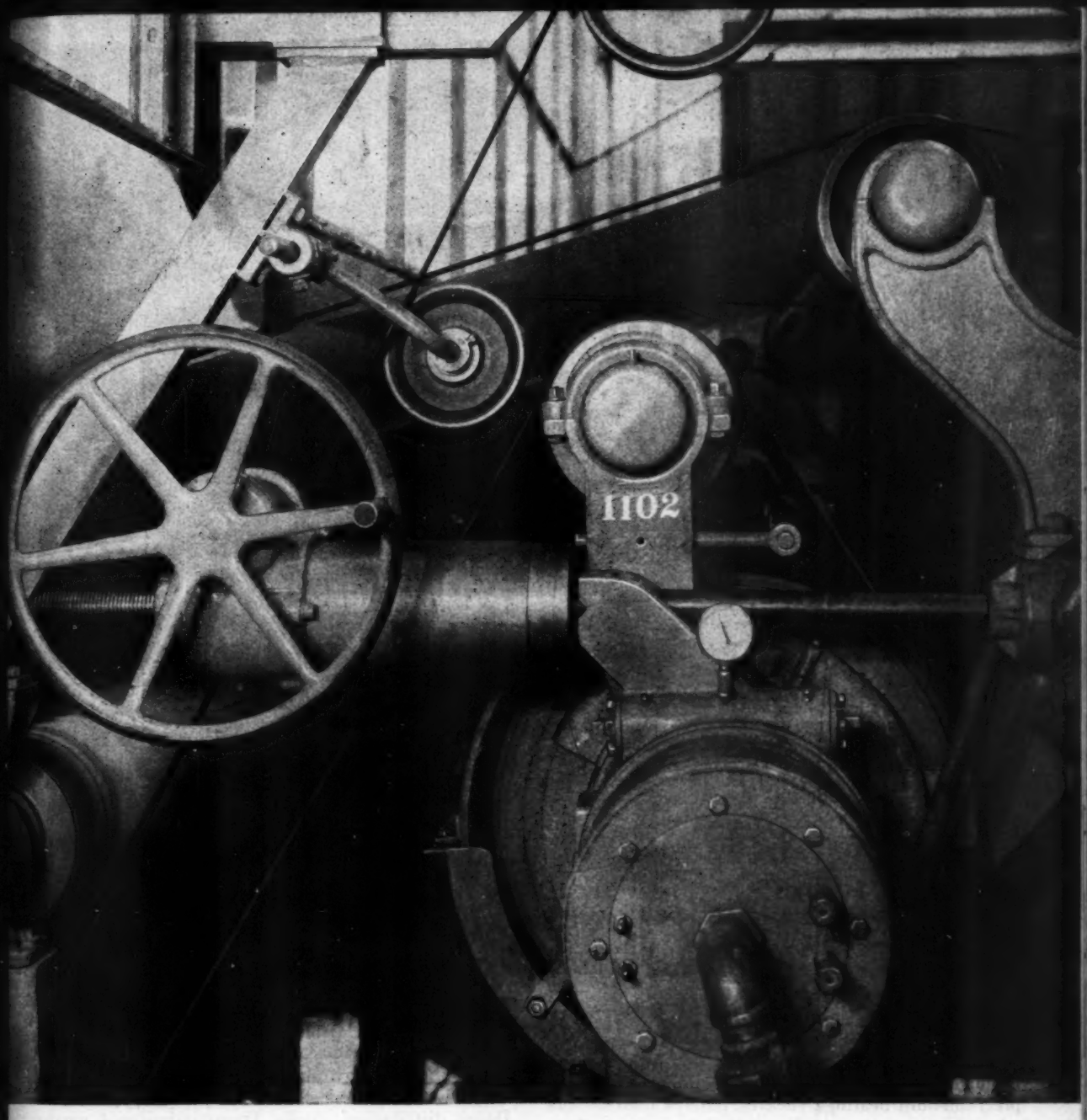
What does a man learn from a razor to make a better cutter?

WATCH FOR THE NEW *Seybold Sixty* OUT SOON

The model Sixty cutting machine is even safer, faster, more economical, because of new improvements which engineer *the human element.*

HARRIS·SEYBOLD

HARRIS PRESSES • SEYBOLD CUTTERS • OTHER GRAPHIC ARTS EQUIPMENT



Accurate, compact, profitable . . .

The patented pressure mechanism on the Beloit Dual Press gives accurate indication of pressure applied—assures a maximum of cushion on the felt—and has a compactness of which every operator will approve. (The pressure gauge is actuated by a glycerine-filled rubber sac.) This mechanism is typical of the many ingenious design features which insure the highly successful operation of the Beloit Dual Press. We've been in the paper-machine business since 1858.—*Beloit Iron Works, Beloit, Wisconsin.*

BELOIT

PAPER MACHINERY

BELOIT IRON WORKS PAPER MACHINERY BELOIT, WIS., U.S.A.

WHEN YOU BUY BELOIT . . . YOU BUY MORE THAN A MACHINE!

The Symbol That Came *To Life!*

The man who walks into your factory wearing this symbol is the living embodiment of a service which gives you the correct answers to your problems in efficient mechanical transmission of power. He's the Dodge *Transmissioneer.*

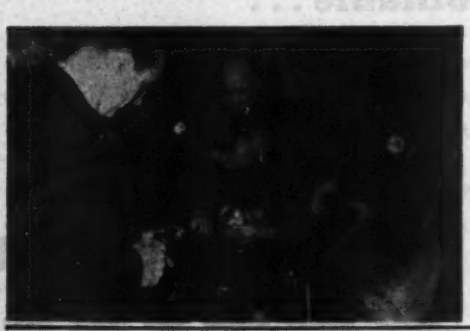
DODGE
MISHAWAKA

Supporting the Transmissioneer is a broad line of mechanical power transmission equipment — Dodge precision-built bearings, sheaves, pulleys, clutches and other drive components. Every Dodge product reflects the engineering advancements and manufacturing "know how" that come from 64 years of experience.

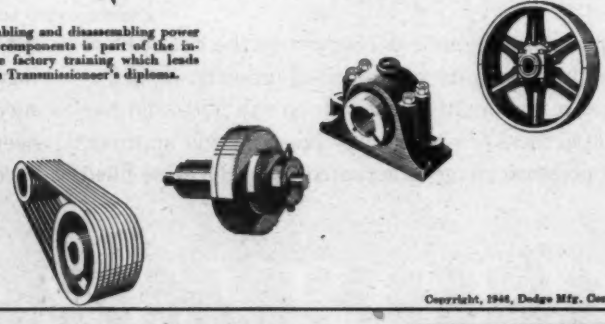
Your Transmissioneer is qualified to select the power drive equipment which best meets your specific needs. His knowledge and experience, plus Dodge products, provide the up-to-date solution of your power transmission problems.

Look in the classified telephone directory under "Power Transmission Equipment" for the Transmissioneer in your territory. He will advise you, without obligation. Your needs can usually be supplied from Dodge distributors' stocks. Transmissioneered means advanced design in power drives.

DODGE MANUFACTURING CORP., MISHAWAKA, IND.



Assembling and disassembling power drive components is part of the intensive factory training which leads to a Transmissioneer's diploma.



Copyright, 1946, Dodge Mfg. Corp.

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY,
ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS
NAME PLATES

IMPROVE
Steam Engine Performance

Use the cylinder oils that . . .

★ Atomize completely

★ Adhere to cylinder walls

WHATEVER the type of reciprocating engine or the steam condition — there is a Texaco steam cylinder oil to bring you the above benefits. Operators everywhere use them to assure efficient, quiet, and economical operation.

The proved effectiveness of Texaco steam cylinder oils is the result of making each one especially to meet the requirements of a particular operating condition. Texaco research is constantly working for improvements — and modern processes, supervised by skilled technicians, assure uniformly fine quality always.

Call on Texaco Lubrication Engineering Service to assist in selecting the proper oil. Get in touch with the nearest of the more than 2300 Texaco distributing plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Lubricants

FOR THE PAPER INDUSTRY

TUNE IN THE TEXACO STAR THEATRE WITH JAMES MELTON SUNDAY NIGHTS ★ METROPOLITAN OPERA BROADCASTS SATURDAY AFTERNOONS

Fast's SELF ALIGNING **Couplings**

SAFEGUARD YOUR POWER TRANSMISSION

145,000 hours of operation

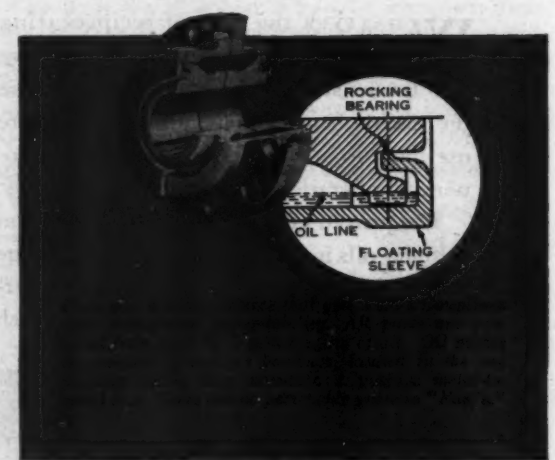
WITH NO DELAYS—OR EXPENSE!

When you buy couplings, you want unquestioned dependability, and there's no better guide in selection than performance on actual jobs.

You can find plenty of evidence like this to support the choice of "Fast's." Here's an example from the Western Maryland Dairy Company plant at Baltimore.

No. 5 Fast's Couplings were installed on a battery of 60-HP motor-driven ammonia compressors in 1922. The equipment operates 24 hours a day from June through September and 18 hours a day the balance of the year. The couplings are still on the original machines, and Mr. C. Guethler, the engineer, states that "they never have given a moment's trouble, and were never taken apart except when it was necessary to work on the connected machines."

If that's the kind of *service* you're looking for, "Fast's" are the *couplings* you're looking for. Their exclusive design features give exclusive service qualities that safeguard your power transmission. Ask for a catalog.



KOPPERS COMPANY, INC. BARTLETT HAYWARD DIVISION
BALTIMORE, MARYLAND

KOPPERS

THE INDUSTRY THAT SERVES ALL INDUSTRY

THE PAPER INDUSTRY and PAPER WORLD

(Reg. U.S. Pat. Off.)

VOLUME 27 - - - - - - FEBRUARY, 1946 - - - - - - - - NUMBER 11

—FEATURES—

Microcrystalline Waxes—Their Manufacture, Properties and Uses in the Paper Industry . . Bruce H. Clary 1679
Lignin-Filled, Laminated-Paper Plastics 1683
Electrical Drive for Corrugators . . . . . J. L. Van Nort 1690
Zein—Its Use in Coatings . . . . . T. T. Collins, Jr. 1694
Technique of Developing Company Policy . . . . . Wilbur M. McFeely 1702
Convention Papers . . . Abridged 1704

—NEWS—

Dear Reader 1642
Trade Winds 1643
Associations . . . . .
Safety . . . . .
Allied . . . . .
Names in the News . . . . .
Personals . . . . .
Necrology . . . . .

—DEPARTMENTS—

Editorials 1663
Current Thought 1664
Paper Sketches . . . . .
Coming Events . . . . .
Safety Contest Scores . . . . .
Practical Shorts 1699
New Equipment and Supplies 1721
Technical Developments . . . . .
Papermaking Patents . . . . .
New Publications . . . . .
Current Market Quotations . . . . .
Index to Advertisers 1725

Published monthly by FRITZ PUBLICATIONS, INC., 59 E. Van Buren St., Chicago 5, Ill.

EDWARD B. FRITZ, Founder
A. SCOTT DOWD, President and Gen. Mgr.
HARRY E. WESTON, Editorial Director
A. C. BRUCE, Secretary
EDGAR C. FARREN, Production Manager
BESSE MERRITHEW, Editor
A. C. L. FRITZ, Vice Pres. and Treas.
G. E. VON ROSEN, Circulation Director
C. J. ELWELL, Circulation Field Rep.

ADVERTISING REPRESENTATIVES

New York • RAYMOND S. VAN NYDECK • 9 Rockefeller Plaza • Circle 7-3085 • New York 20, N. Y.
Boston • MEADE AND COMPANY • 403 Statler Building • Liberty 9677 • Boston 16, Mass.
Cleveland • L. M. PERKINS • 3277 DeSoto Ave. • Yellowstone 6504 • Cleveland Heights 18, Ohio
Chicago • JOHN D. HENDERSON • 59 E. Van Buren Street • Wabash 3543 • Chicago 5, Illinois
San Francisco • NOURSE ASSOCIATES • 582 Market Street • Exbrook 6685 • San Francisco 4, Calif.
Los Angeles • NOURSE ASSOCIATES • 412 West 6th Street • Vandike 5875 • Los Angeles 14, Calif.

THE PAPER INDUSTRY and PAPER WORLD is indexed regularly in "The Industrial Arts Index." An index to each volume is issued annually by the publisher as Section Two of the April number.

Copyright 1946 by Fritz Publications, Inc.

Member: Audit Bureau of Circulation, Associated Business Papers, Inc.

Entered as second class matter June 29, 1938, at the post office at Chicago, Ill., under the Act of March 3, 1879. Subscriptions in the United States, U. S. Possessions, Canada, Cuba and Mexico, $2.00 for one year, $3.00 for two years. All other countries $3.00 for one year, $5.00 for two years.

EVAPORATORS-CONDENSERS-FILTERS

One frequently neglected source of economy that is particularly adaptable to post-war plant improvement is the use of a surface Condenser on a multiple-effect Evaporator.

The use of a low-cost surface Condenser makes possible the conversion of low temperature heat, usually wasted, to the heating of wash waters.

The services of Goslin-Birmingham's Reconversion Department are available for the study of your individual plant problems. A thoroughly-trained, experienced staff of engineers fully abreast of current conditions and post-war operational methods, stands ready to serve you.

GOSLIN-BIRMINGHAM MANUFACTURING CO., INC.
BIRMINGHAM, ALABAMA

Lower Distribution Costs for Paper—5 New Bulletins report successful Load-Transportation Methods in Pulp and Paper Mills, Converting Plants, Printing and Publishing Plants

News for Paper Executives! These 5 interesting Bulletins describe Industrial Logistics—today's method of transporting plant and warehouse loads in Master Units, at increased speed and at greatly-reduced costs.

Types of containers are discussed individually—Boxes, Barrels, Bags and Bales—with profuse illustrations from photographs demonstrating applications of Pallets and Skids in the complete movement of goods from Supplier—during all stages of Manufacturing—through Distribution to final customer.

Interested Paper Executives are invited to request all 5 Booklets, without obligation. Please use the coupon, or write or wire for an immediate interview with your nearby Elwell-Parker Materials-Handling Consultant.

The Elwell-Parker Electric Company, 4241 St. Clair Ave., Cleveland 14, Ohio.

Clip, attach to your letterhead, and mail to Elwell-Parker, Cleveland:—

Send your 5 Industrial Logistics Bulletins to

Name _____

Title _____

Firm _____

City _____ State _____ PI&PW

ELWELL-PARKER
POWER INDUSTRIAL TRUCKS
Established 1893

SPECIFY "GENERAL CHEMICAL"

...improve formation—appearance—quality

Visual as well as laboratory testing of paper formation establishes the necessity for using a pure, uniform "Alum" in manufacturing a high-grade sheet.

General Chemical Aluminum Sulfate—as well as the Company's other paper-making chemicals—is made with strict attention to every production detail. Constant laboratory control assures product uniformity and purity. For "Alum" you can rely upon, specify **General Chemical:**

aluminum sulfate

Standard—Lump; Ground, 99% thru 8 mesh, 95% thru 10 mesh; Powdered, 95% thru 100 mesh.

Iron Free—Lump, approx. 2½"; Ground, thru 8 mesh.

sodium silicate

Solutions: From 38°—60° Baume — Wt. Ratio (Na_2O to SiO_2) from 1:2.00—1:3.40

Appearance: Opalescent to clear.

GENERAL CHEMICAL COMPANY products for the paper industry

Aluminum Sulfate (Standard and Iron Free) • Copper Sulfate • Muriatic Acid (Hydrochloric) • Sodium Fluoride • Sodium Silicate • Sodium Metasilicate • Glauber's Salt (Crystal or Anhydrous) • Salt Cake Sodium Sulfide • Sodium Hyposulfite • Sodium Sulfite (Anhydrous) Sodium Bisulfite (Solution or Anhydrous) • Disodium Phosphate Trisodium Phosphate • Tetrasodium Pyrophosphate • Sulfuric Acid Nitre Cake (Sodium Bisulfate) • Nitric Acid

BASIC CHEMICALS
GENERAL CHEMICAL COMPANY
FOR AMERICAN INDUSTRY

GENERAL CHEMICAL COMPANY
40 RECTOR STREET, NEW YORK 6, N. Y.

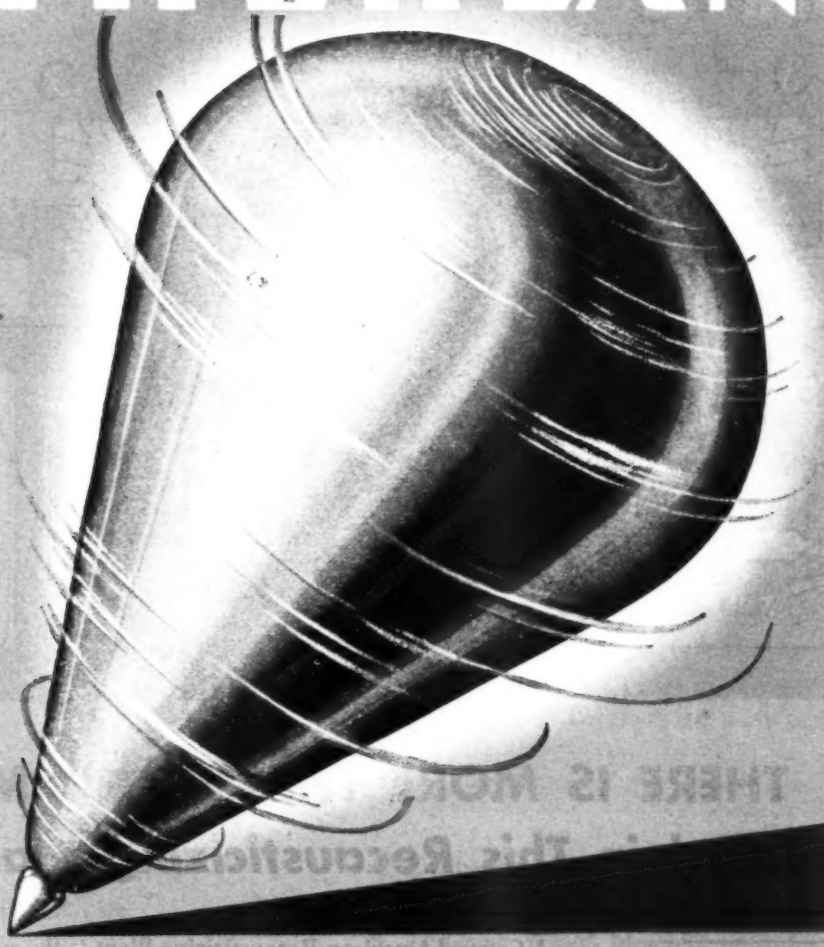
Sales and Technical Service Offices: Atlanta • Baltimore • Boston • Bridgeport (Conn.) Buffalo • Charlotte (N. C.) • Chicago • Cleveland • Denver • Detroit • Houston • Kansas City • Los Angeles • Minneapolis • New York • Philadelphia • Pittsburgh • Providence (R. I.) San Francisco • Seattle • St. Louis • Utica (N. Y.) • Wenatchee • Yakima (Wash.)
In Wisconsin: General Chemical Wisconsin Corporation, Milwaukee, Wis.
In Canada: The Nichols Chemical Company, Limited • Montreal • Toronto • Vancouver

y

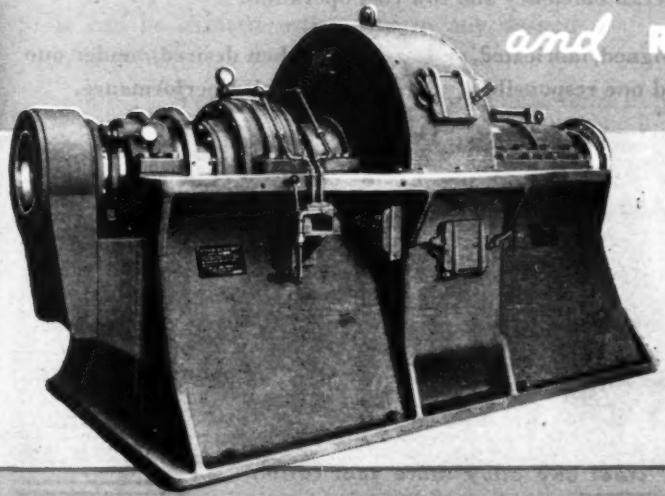
ry

6

SUTHERLAND



Continuous BEATING and REFINING system

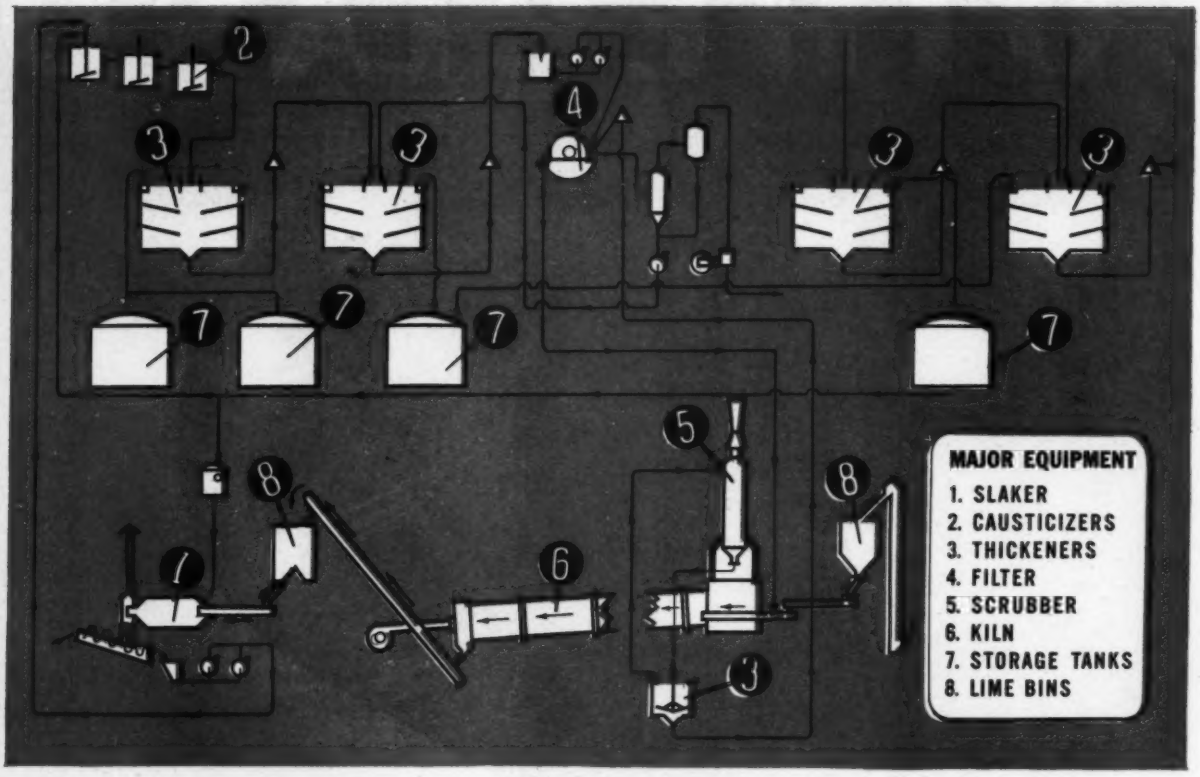


FOR EVERY PAPER MAKING FIBER

SUTHERLAND REFINER CORPORATION

TRENTON, NEW JERSEY · *Manufactured in the United States by Valley Iron Works Co., Appleton, Wis.*

SUTHERLAND REFINER LIMITED, 319 DRUMMOND BLDG., MONTREAL, P.Q., *Manufactured in Canada By The John Bertram & Sons Co. Ltd., Dundas, Ontario*



THERE IS MORE THAN EQUIPMENT

Contained in This Recausticizing Plant Layout

EQUIPMENT FOR PULP & PAPER MILLS

EVAPORATORS
DIGESTERS
BLOW TANKS
TURBO-MIXERS
FILTERS
KILNS
THICKENERS
STORAGE TANKS
BINS
SLAKERS

A General American Recausticizing Plant is the cumulative effort of pulp mill men, design engineers, metallurgists, and fabrication experts.

This assures a plant in which the various units work together to produce a high overall efficiency and low cost operation.

Equipment designed, fabricated, and installed, (when desired), under one supervision and one responsibility makes for superior performance.

Because all the major units; slaker, causticizers, thickeners, filter, kiln, bins, and tanks are all manufactured in our own shops, it is possible to schedule fabrication to coincide with your building program.

Ask for further information. Inquiries will be promptly and intelligently answered.

General American

TRANSPORTATION CORPORATION

process equipment • steel and alloy plate fabrication

SALES OFFICE:
516a Graybar Bldg., New York 17, N. Y.
WORKS: Sharon, Pa.; East Chicago, Ind.

GATX GENERAL AMERICAN

OFFICES: Chicago, Louisville, Cleveland, Sharon, Orlando, St. Louis, Salt Lake City, Pittsburgh, San Francisco, Washington, D. C.

A Few Important Facts About

GROUNDWOOD BLEACHING

with

BECCO HYDROGEN PEROXIDE

1. Easy to handle.
2. Shipped in Drums or tank cars.
3. Can be stored in tanks and pumped directly to point of use.
4. Actual feeding of peroxide is automatic and fully controlled.
5. It can be diluted with water in any desired proportions.
6. Can be measured and metered as easily as water.
7. Reduces labor and hazards.
8. The most versatile bleaching agent for all types of materials.
9. Can be used for bleaching at any desired pH.
10. Because of its high stability, ease of handling and simplicity of application has therefore become the most important bleaching agent in the huge textile industry.

Avail yourself of Becco's wide experience in bleaching with hydrogen peroxide; of Becco's extensive research data for bleaching groundwood pulp. Learn about Becco's system of feeding chemicals automatically. Now is the time to investigate the use of Becco Hydrogen Peroxide—a water-white liquid—for groundwood bleaching. Write to:

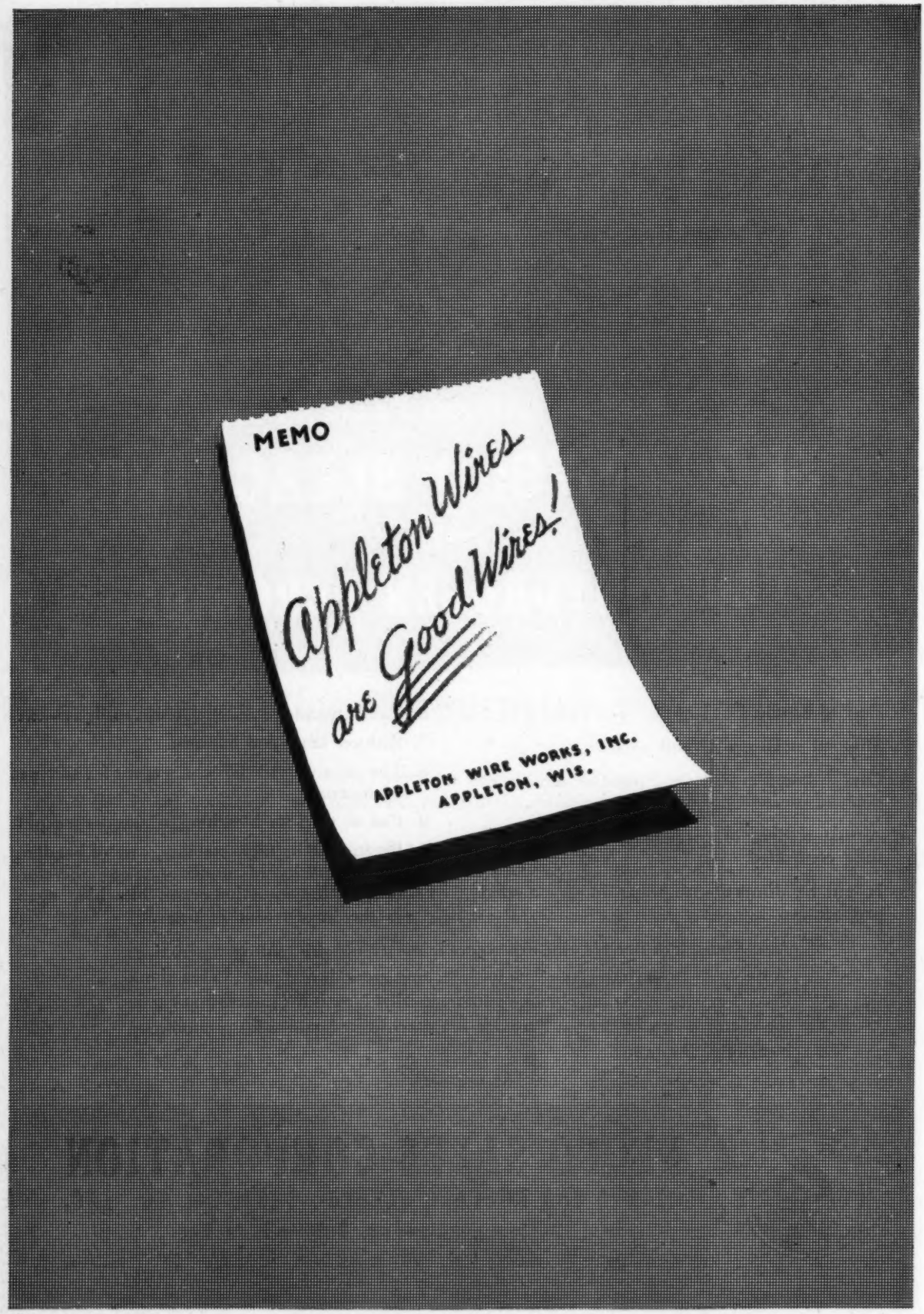
BECCO

BECCO SALES CORPORATION

AGENTS FOR BUFFALO ELECTRO-CHEMICAL CO., INC.

20 Sawyer Avenue, Buffalo 7, N. Y.

New York Boston Philadelphia Chicago Charlotte


MEMO
Appleton Wires are Good Wires!
APPLETON WIRE WORKS, INC.
APPLETON, WIS.

keeping skins and hides fresh

How Dowicides Keep Bacteria in Check

Destructive bacteria are effectively controlled by Dowicides in leather manufacturing, one of many industries which has reduced damage and losses through the use of these Dow germicides and fungicides.

Skins and hides in the soaking pits can be protected by the use of Dowicides, thus preventing excessive hair slippage and loss of hide substance.

Work done under a Dow-supported fellowship in the Leather Tanners' Research Council at Cincinnati several years ago proved that Dowicides are effective in preventing bacterial action.

Such a preventive step is especially important in warm weather or if skins or hides must soak for unusually long periods, such as over week-ends.

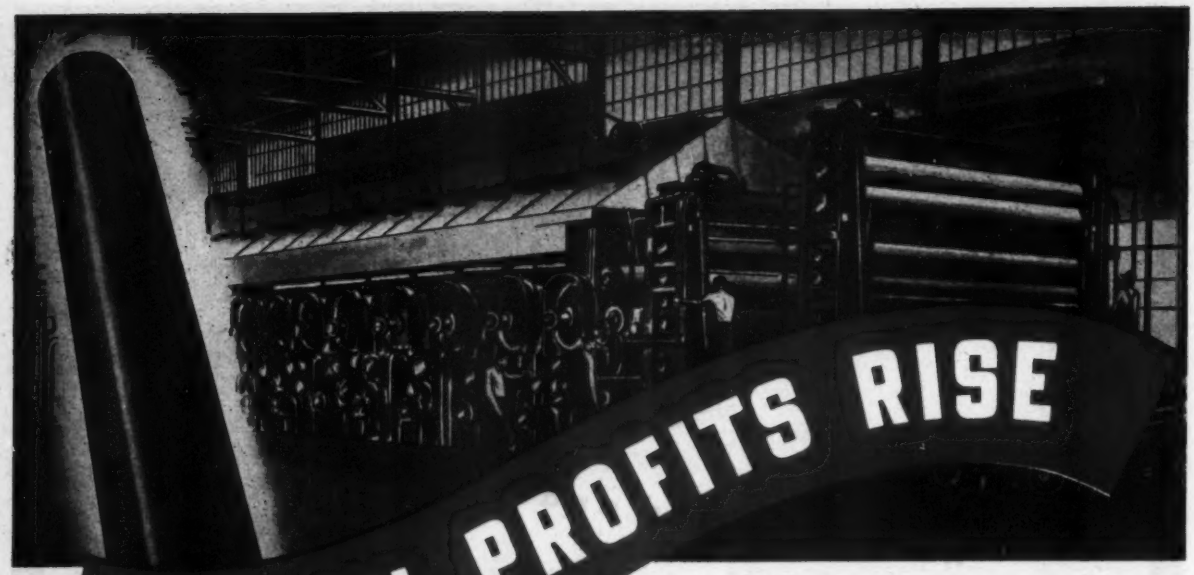
Dowicide pays off in any industry where bacteria, mold, fungi or termites attack products or materials. Let Dow show you how Dowicides can help you. Call any Dow sales office.

DOWICIDE

control termites mold and bacteria

DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND AGRICULTURE



WATCH PROFITS RISE

When You Install TIMKEN SEAMLESS TUBES of 5% Nickel Steel in Black Liquor Evaporators

Profits go up and costs go down when Timken Seamless Tubes of 5% Nickel steel are installed in Black Liquor Evaporators.

These tubes have been developed for the sole purpose of combating the corrosive conditions of Black Liquor Units. In actual installations they have provided two to six times the life of competing tubes. This long life means reduced installation costs, less wear and tear on headers.

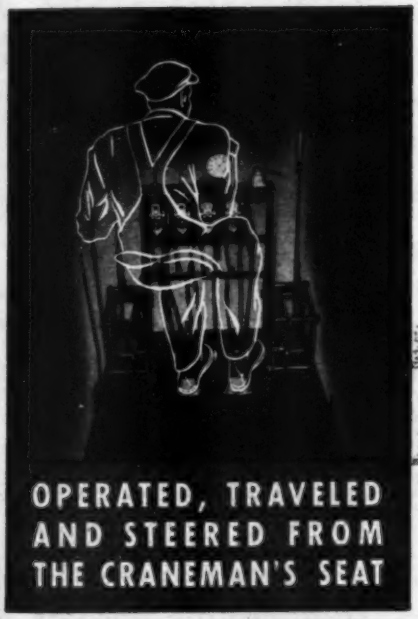
Use these qualities to force profits up and costs down. For specifications of Timken Seamless Tubes of 5% Nickel steel write Steel and Tube Division, The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

SEAMLESS STEEL TUBES

THIS CRANE Saves its Cost IN MAN-HOURS!



OPERATED, TRAVELED AND STEERED FROM THE CRANEMAN'S SEAT

NEW ORTON AERO-CRANE Air-Controlled FOR ONE-MAN HANDLING!

- AUTO-TRUCK MOBILITY
- ANTI-FRICTION BEARINGS
- AIR-OPERATED CLUTCHES
- SAFETY HOIST BRAKES
- BALANCED WEIGHT RATIO
- SIMPLE, POWERFUL DESIGN
- RANGE OF SEVEN MODELS

SEND FOR CATALOG No. 73

Without fatigue, and all day long, *one man,* with an Aero-Crane, does the work of 4 or 5 men—gets your material onto the stockpile and off again at minimum cost. One man handles those 200 to 1000 lb. loads that otherwise eat up the time of a crew!

Designed for rapid yard work, the Aero-Crane goes anywhere a truck can go. You can travel it light or loaded with boom in any position. Your craneman needs no helper to steer or operate. Tough-built, with anti-friction bearings throughout, electric welded construction, non-burn clutches, air-controls, Aero-Crane keeps going free of breakdowns—pays for itself in saved man-hours alone!

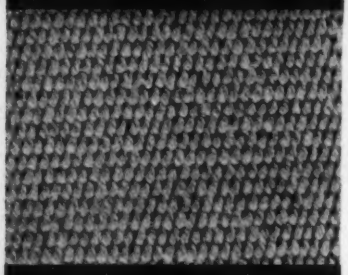
Built in a range of seven models. Capacities of 3,500 to 50,000 lbs. at 12 foot radius. Diesel or gasoline powered.

ORTON CRANE & SHOVEL CO.
608 S. DEARBORN ST., CHICAGO 5, ILL.

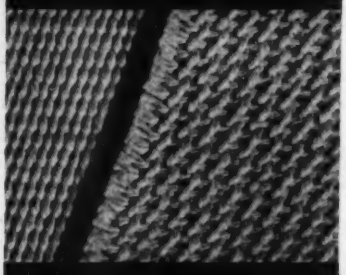
SENSITIZED

POWER

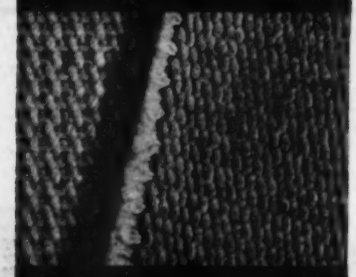
BRANDON



"Triumph" 3 ply 50-54 oz. Cotton



"Zephyr" 3 ply 45 oz. Cotton



"Zephyr" Cotton Asbestos

"Scapa Hall" Asbestos

Brandon Corporation

GREENVILLE, S. C.

Fitchburg Duck Mills

FITCHBURG, MASS.

manufacturers of

FINE DRYER FELTS

are now combined under one ownership and management

Created to give you greater Service, Research and Development in every Dryer Felt application.

Special weaves are available in both Cotton and Asbestos Felts to improve the quality of your finish and quantity of production.

Quick service from over 30 felt looms and convenient plant locations at Fitchburg, Mass. and Greenville, S. C. . . . ready to work with you.

REPRESENTATIVES

Stedman Paper Company
Holyoke, Massachusetts

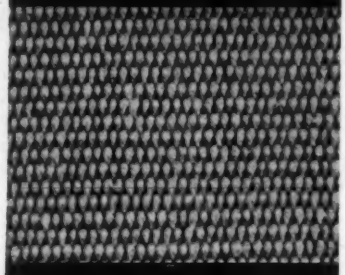
Jack E. Johnson
Oswego, Oregon

Corwin J. Jewell
Watertown, New York

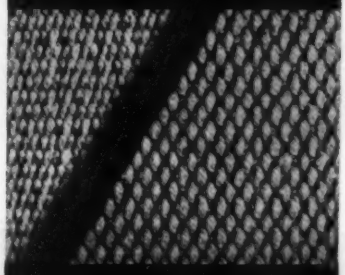
Industrial Supplies Corp.
Appleton, Wisconsin

The Christian Company
Richmond, Virginia

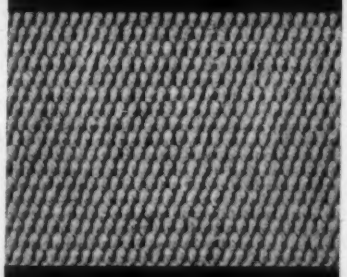
FITCHBURG



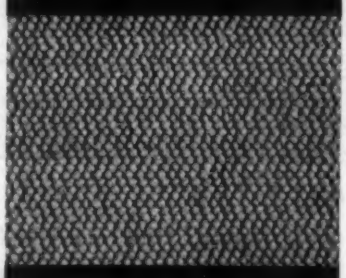
"Triune" 3 ply 52 oz. Cotton



"Diamond Back" 2 ply 46 oz. Cotton



"Multiple Weave" 2 ply 52 oz. Cotton



"Baker" 4 ply 48 oz. Cotton

BRANDON
DRYER FELTS

Morey Paper Mill Supply Co.

309 SOUTH ST., FITCHBURG, MASSACHUSETTS

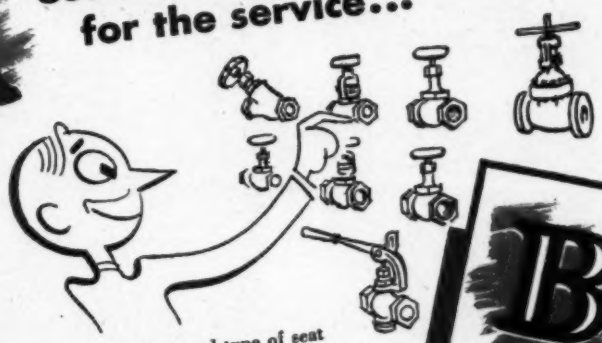
Sole Distributors for

WOODWARD, BALDWIN & CO., BALTIMORE, MD.

FITCHBURG DUCK MILLS
ESTABLISHED 1844.
DRYER FELTS

THE A-B-C's OF TROUBLE-FREE VALVE PERFORMANCE

A Use the right type of valve for the service...

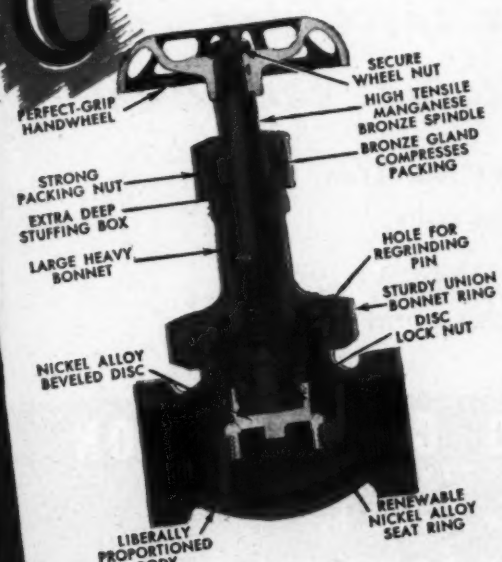


Select the metal, pattern, and type of seat best suited to the particular service . . . Get advice from us or your Jenkins Distributor.

B Place valves correctly in the line...

Where and how valves are installed makes a difference in their efficiency and service life . . . Write for booklet No. 944 on installation.

C Choose Jenkins Valves for lifetime economy!



EXAMPLE: Fig. 950 GLOBE

THESE BRONZE GLOBE valves are especially recommended for the control of up to 200 lbs. steam at 550° F.; up to 400 lbs. non-shock cold oil, water, gas, where service conditions are severe, tightness is essential and operation is frequent. Easy to dismantle and reassemble, easy to regrind without removal from the line. Insertion of handy regrinding pin enables spindle to serve as grinding tool. Face of seat ring parallels and equals that of disc, assuring constant contact area, tight closure, prevention of shoulder or grooves in regrinding. Disc and seat ring renewable.

As in all Jenkins Valves, *better* design, *better* materials, *better* workmanship, insure lifetime economy in long, trouble-free service and minimum maintenance costs.

Sold Through Industrial Distributors Everywhere

Jenkins Bros., 80 White Street, New York 13; Bridgeport; Atlanta; Boston; Philadelphia; Chicago; San Francisco. Jenkins Bros., Ltd., Montreal; London.

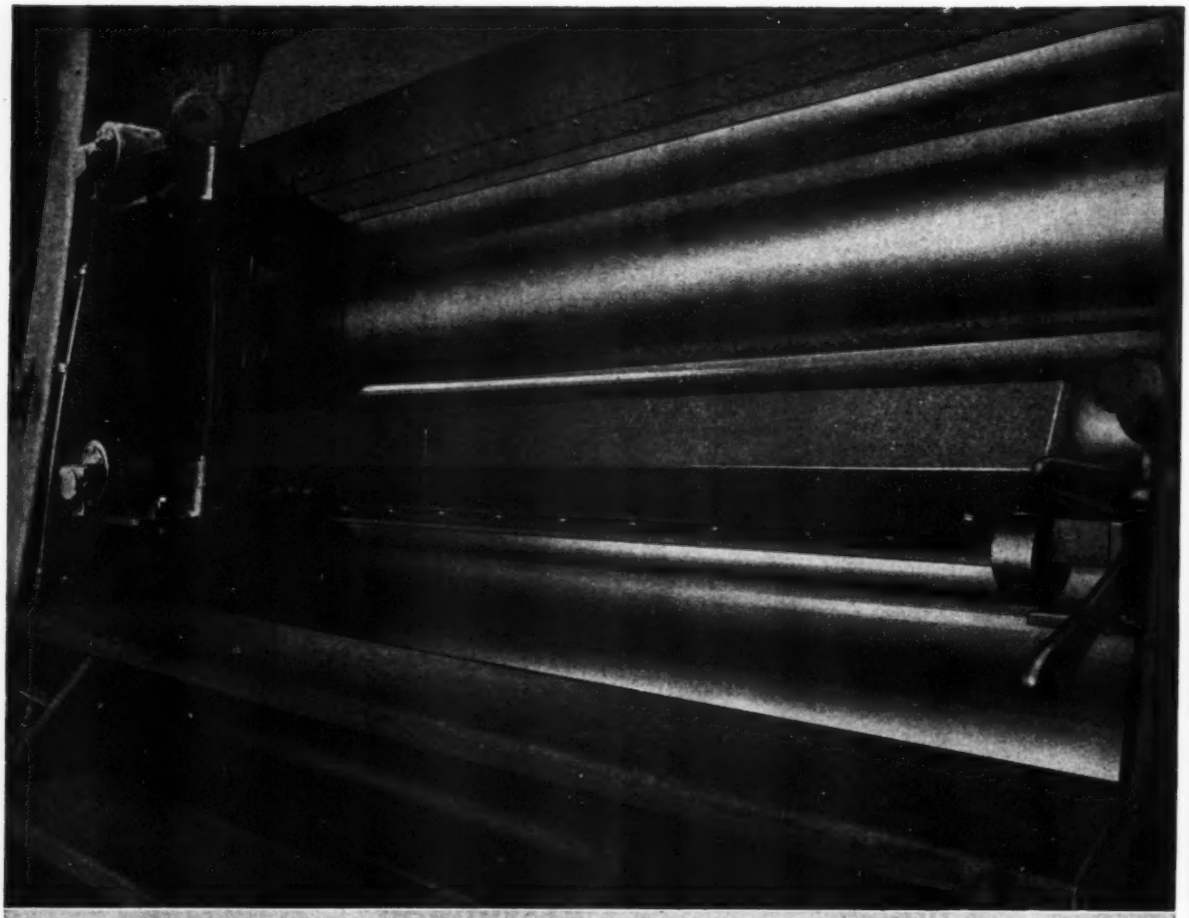
JENKINS VALVES

LOOK FOR THIS DIAMOND MARK SINCE 1864

TRADE JENKINS MARK

For every service . . . in Bronze, Iron, Cast Steel, Corrosion-Resisting Alloys . . . 125 to 600 lbs. pressure.

Jenkins Bros



New machine buyers are specifying Lodding Doctors as original equipment

LODDING supercalender doctors for cotton, fibre and chilled iron rolls.

LODDING Doctors will improve your finish, and keep your rolls clean and glossy.

LODDING ENGINEERING CORPORATION

WORCESTER, MASSACHUSETTS, U. S. A.

Represented outside of New England by

W. E. GREENE CORPORATION

Woolworth Building NEW YORK

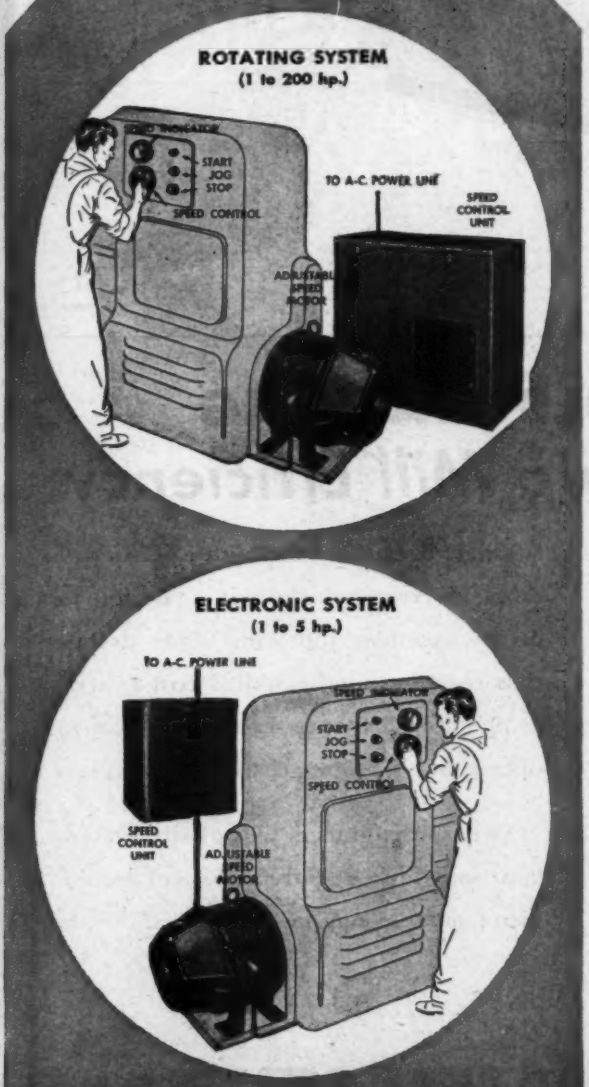
PULP and PAPER MILL ACCESSORIES, Ltd., 2023 Aylmer Street, MONTREAL, QUEBEC

1946

Why pay more than you need

RELIANCE V★S DRIVE

to get D-c. Power where you want it?



SAVE $25 to $60 per Kilowatt of installed D-c. capacity with RELIANCE V★S DRIVE

If in your plant—as in so many others—there is a need for supplying D-c. power for adjustable-speed operations, you are likely to find that *spot conversion of A-c. power* with the Reliance V★S Drive is the perfect answer. This is true for two reasons.

FIRST—V★S DRIVE saves you from $25 to $60 per kilowatt as compared to the cost of bringing in and applying D-c. power from some central source. These figures are based on a wide variety of applications.

SECOND—V★S DRIVE gives you unlimited flexibility of machine operation and application. This includes both automatic and manual control with smooth starting, stopping and reversing. Also, an infinite range of stepless speed changes, automatically maintained tension and many other specialized advantages.

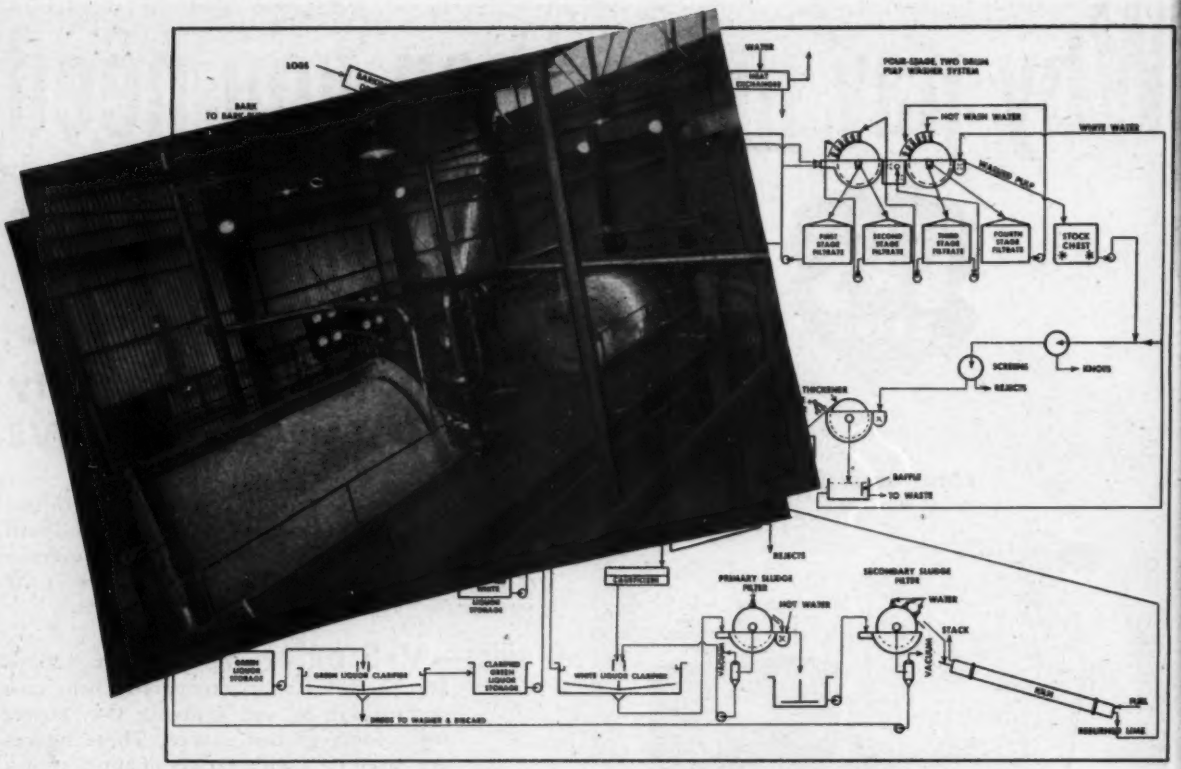
Before installing D-c. power lines, learn what you can save with Reliance V★S Drive, which operates from your regular A-c. circuits. And see what V★S, with all-electric control, can do in improving quality and quantity of output, while reducing installation, operating and maintenance costs. Write today for the up-to-date story on spot conversion of A-c to D-c power.

We'll be looking for you at the
20TH EXPOSITION OF CHEMICAL INDUSTRIES
Grand Central Palace • New York • Week of February 25th

RELIANCE ELECTRIC & ENGINEERING CO.
1078 Ivanhoe Road • Cleveland 10, Ohio
Birmingham • Boston • Buffalo • Chicago • Cincinnati • Denver • Detroit • Gary
Greenville • Houston • Kalamazoo • Kansas City • Knoxville • Los Angeles
Milwaukee • Minneapolis • New Orleans • New York • Philadelphia • Pittsburgh
Portland, Ore. • Rockford, Ill. • St. Louis • San Francisco • Seattle • Syracuse
Tampa • Tulsa • Washington, D. C.

RELIANCE A-C D-C MOTORS

"Motor-Drive is More Than Power"



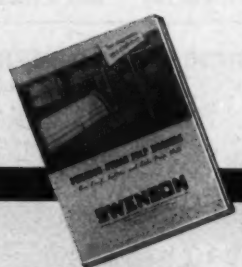
MULTI-STAGE PULP WASHING *for Pulp Mill Efficiency*

The best way to cope with keener competition is to achieve highest possible efficiency in the various stages of processing. Aggressive pulp mill management will gain definite advantages by replacing outmoded equipment with the highly efficient Swenson-Nyman Multi-Stage Pulp Washer. Because of the high efficiency of Swenson-Nyman washers it is possible to do an excellent job with fewer drums, thus reducing total installed cost as well as operating expense. Equipment now in operation is bringing remarkable savings.

Swenson engineers will gladly analyze your individual requirements and recommend suitable equipment.

A Valuable Booklet

containing photographs, diagrams, and facts of interest to pulp mill executives will be gladly mailed on request. Ask for Bulletin F-104 today.



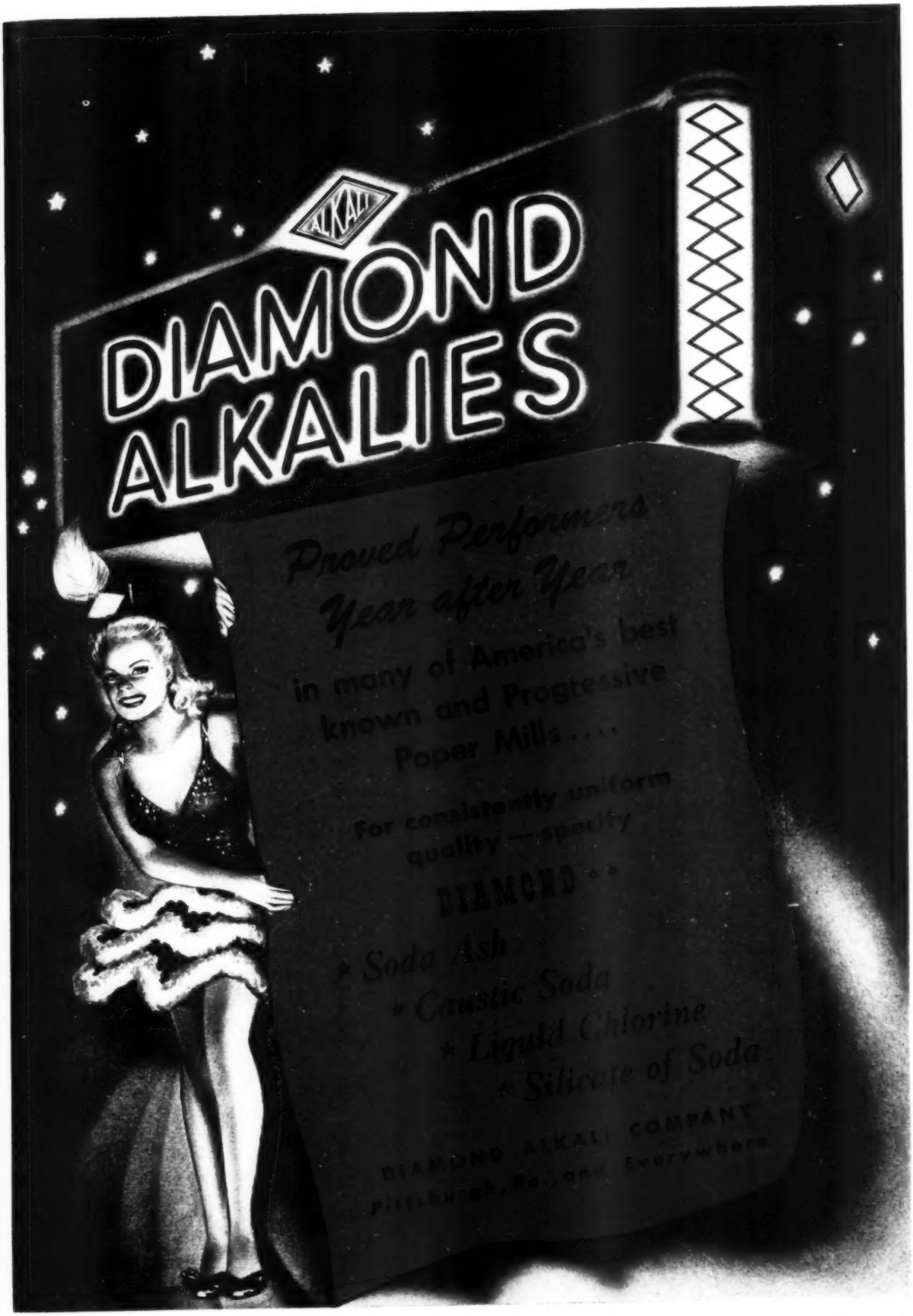
- Black Liquor Evaporators
- Pulp Washers • Lime Sludge Filters
- Causticizers • Digester Blow Condensers
- Surface Condensers
- Kraft Pulp Deckers

SWENSON

SWENSON EVAPORATOR COMPANY

Division of Whiting Corporation

15653 Lathrop Avenue, Harvey, Ill.

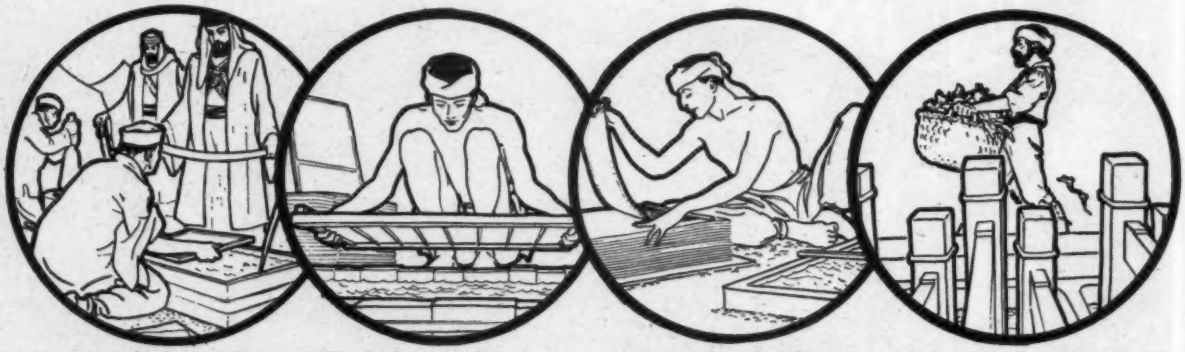

ALKALI
DIAMOND
ALKALIES
Proved Performers
Year after Year
in many of America's best
known and Progressive
Paper Mills....
For consistently uniform
quality — specify
DIAMOND
* Soda Ash
* Caustic Soda
* Liquid Chlorine
* Silicate of Soda
DIAMOND ALKALI COMPANY
PITTSBURGH, PA. ... Everywhere

NEARLY 2000 YEARS AGO in China, Ts'ai Lun first discovered and developed the paper-making process.

Paper

PACEMAKER OF PROGRESS

Mulberry bark or rags were mashed, mixed with water, poured over a screen, dried.



Seven hundred years later, the Arabs forced the secret from some Chinese captives.

The Arabs carried the secret of paper-making to Bagdad ... whence it reached Cairo.

A thousand years after its discovery—this valuable art first appeared in Morocco.

When use of the process arrived in Spain, rags were pulped in a stamping mill.

It took 200 years for a knowledge of paper-making to spread through France, Italy, Germany, Holland, and England. The quality of hand-made paper improved and its uses steadily increased, but the basic method of making paper remained unchanged. It was still another 200 years before William Rittenhouse erected, at Germantown, Pennsylvania, in 1690, the first paper mill in America. The following century saw 100 mills operating in the Colonies.

F. C. HUYCK & SONS

Kenwood Mills

Albany **New York**

KENWOOD WOOL PRODUCTS

Nearly 17 centuries passed while a knowledge of paper-making travelled from its birthplace in China to the New World. Yet in only a little more than 75 years since the introduction of the wood-pulp process and the development of the felt industry in the United States, plentiful paper has helped to revolutionize culture and civilization. This dramatic story is graphically told in the forthcoming sound-color film "Paper—Pacemaker of Progress," presented as a tribute to the paper industry by F. C. Huyck & Sons on its 75th Anniversary.

Class	Type	Kind of Soap	Upper Temp. Limit	Characteristics
Lime Soap (Calcium)	Cup	Lime fat	175° F.*	Smooth, water resistant, separates on boiling out water content, limited consistency loss on working.
	Axle	Lime rosin	150° F.	Smooth, sticky, water resistant, separates on boiling out water content, great consistency loss on working.
Soda Soap	Fibre and Sponge	Soda fat	375° F.	Fibrous, not water resistant, does not separate at elevated temperatures, variable consistency loss on working.
	Medium and Short Fibre	Soda fat	375° F.	Semi-smooth, not water resistant, does not separate at elevated temperatures, variable consistency loss on working.
	Smooth (block, brick)	Soda fat (variable soda rosin content)	400° F.	Smooth, hard, not water resistant, does not separate at elevated temperatures.
Aluminum Soap	— — —	Aluminum fat	240° F. (average)	Smooth, gel-like or stringy, water resistant, becomes fluid at elevated temperatures, limited consistency loss on working.
Compounds	Residuum	Usually none	— —	Smooth, black, adhesive, excellent pressure and water resistant.

*As high as 200° F. for special lime soap greases where such maximum temperature is intermittent.

To get longer life from bearings

(1) Use the right grease

The difficulties of choosing the right type of grease for any particular application are demonstrated in the table above. This lists the general operating characteristics of the more common types of grease. In addition, each type comes in many grades and all have advantages for specific grease lubricating jobs.

Many plant men have given up trying to guess their way through this maze. They know that Standard Oil makes all types of grease. They've found that Standard Oil Lubrication Engineers are qualified by training and experience to analyze operating conditions and fit the right type and grade of grease to the job. But the right grease is only half the problem. The other is:

(2) Good Maintenance Practices

The proper functioning of even the best grease in a bearing depends upon many factors such as condition of seals, bearing alignment and lubricant application, to name a few. A common tendency, for example, is to apply too much grease to anti-friction bearings. This results in excessive churning of the grease, undue friction and leakage.

Here again a Standard Oil Lubrication Engineer can help you by determining the cause of bearing or lubricating failures. Put your lubricating problems into the hands of one of these Lubrication Engineers. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Ill., for the Engineer nearest you.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

MIDWEST PIPE FABRICATING PLANTS

Make a CONTINUOUS CHECK

on the HIGH QUALITY of MIDWEST WELDING FITTINGS

Four modern Midwest pipe fabricating plants supply piping for all purposes and pressures to a great variety of industries from coast to coast. These Midwest plants are large users of Midwest Welding Fittings. This regular everyday use of these fittings in fabricating both simple and complex piping subassemblies provides an accurate and continuous check of their quality . . . of correct dimensions . . . of uniformity . . . of accurate angularity, etc.

But this daily use in our own fabricating plants does more than check quality . . . it makes certain that Midwest Fittings are thoroughly practical . . . that they meet the needs of modern piping practices from a design standpoint . . . that they are easy to lay out and weld. For example: the accuracy of Midwest machining methods makes it possible for the user to cut his pipe before receiving his Midwest Welding Fittings . . . he can depend upon the catalog dimensions. Buyers of Midwest Welding Fittings get the benefit of this unique situation. We sell you the same fittings we use . . . assuring you of quality fittings that are correctly designed and that save time and money on many different kinds of piping jobs. Bulletin WF-41 gives all the facts; ask for a copy.

MIDWEST WELDING FITTINGS IMPROVE DESIGN AND REDUCE PIPING COSTS

MIDWEST

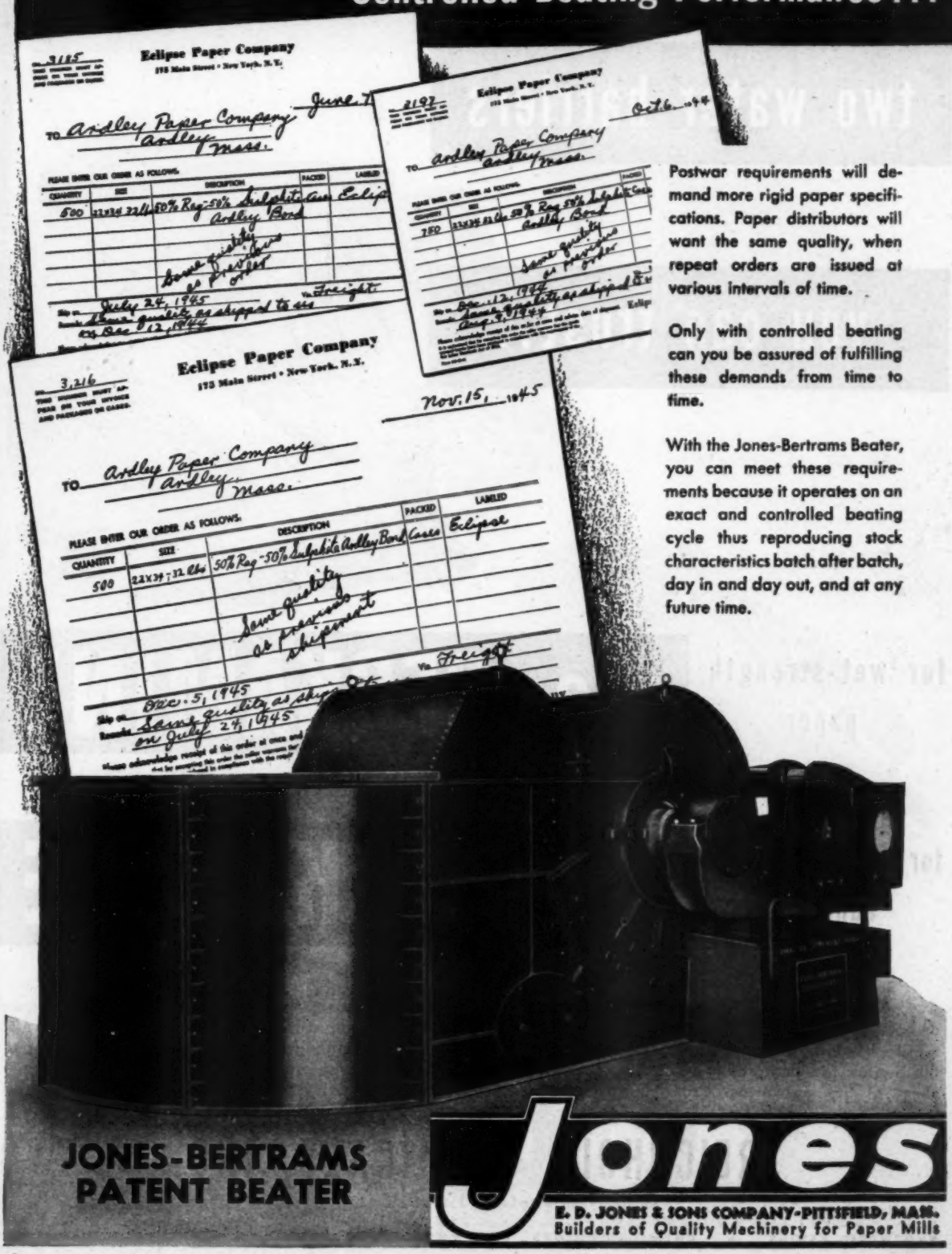
PIPING & SUPPLY COMPANY, Inc.

Main Office: 1450 South Second St., St. Louis 4, Mo.

Sales Offices: New York 7—30 Church St. • Chicago 3—645 Marquette Bldg. • Los Angeles 33—520 Anderson St. • Houston 2—229 Shell Bldg. • Tulsa 3—533 Mayo Bldg. • Atlanta 3—Red Rock Bldg • South Boston 27—426 First St. • Distributors in Many Cities

JONES-BERTRAMS PATENT BEATER

Controlled Beating Performance . . .



Postwar requirements will demand more rigid paper specifications. Paper distributors will want the same quality, when repeat orders are issued at various intervals of time.

Only with controlled beating can you be assured of fulfilling these demands from time to time.

With the Jones-Bertrams Beater, you can meet these requirements because it operates on an exact and controlled beating cycle thus reproducing stock characteristics batch after batch, day in and day out, and at any future time.

JONES-BERTRAMS PATENT BEATER

Jones

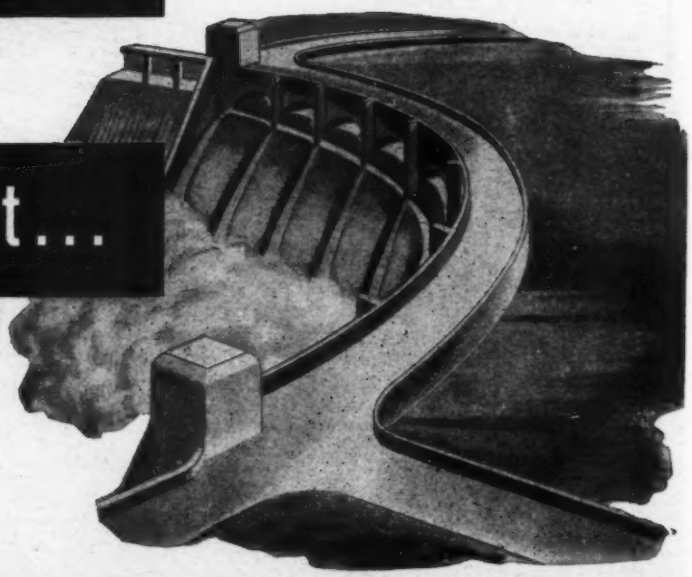
E. D. JONES & SONS COMPANY-PITTSFIELD, MASS.
Builders of Quality Machinery for Paper Mills

WORLD'S LARGEST PRODUCER OF SYNTHETIC RESINS

RCI

two water barriers

you can trust...



for wet-strength paper

P426 BECKAMINE

for water-resistant adhesives

P364 BECKAMINE

P-426 Beckamine—A urea-formaldehyde resin which heightens wet-strength and also increases tensile strength, fold and mullin. Can be applied in the beater, fan pump or head box or directly to the sheet at the size press. Exceptionally stable, too.

P-364 Beckamine—A low-cost resin for V-Board adhesives imparting exceptional water resistance. Low formaldehyde content minimizes unpleasant fumes in formulating. Available in any quantity. For details write the Sales Department at Detroit.

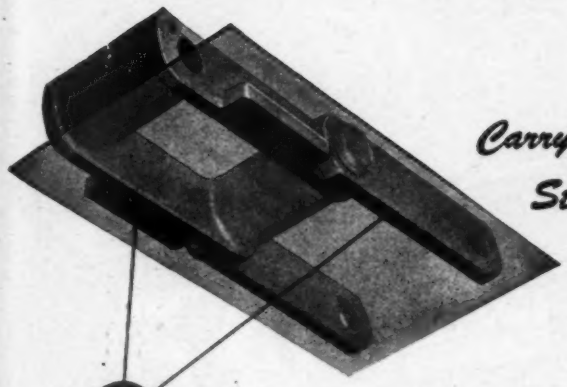
REICHHOLD CHEMICALS, INC.

General Offices and Main Plant, Detroit 20, Michigan

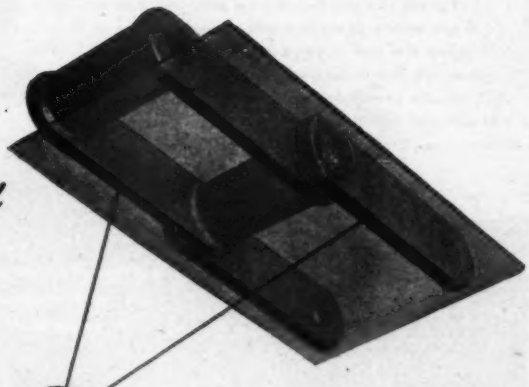
Other Plants:
Brooklyn, New York • Elisabeth, New Jersey • South San Francisco, California • Tuscaloosa, Alabama • Liverpool, England • Paris, France • Sydney, Australia

SYNTHETIC RESINS • CHEMICAL COLORS • PHENOLIC PLASTICS • INDUSTRIAL CHEMICALS

Compare the WEARING SURFACE of JEFFREY PW 132 CHAIN with ORDINARY 132 CHAIN

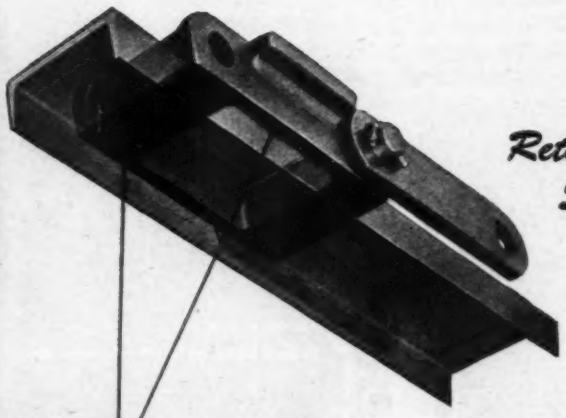


Carrying Strand

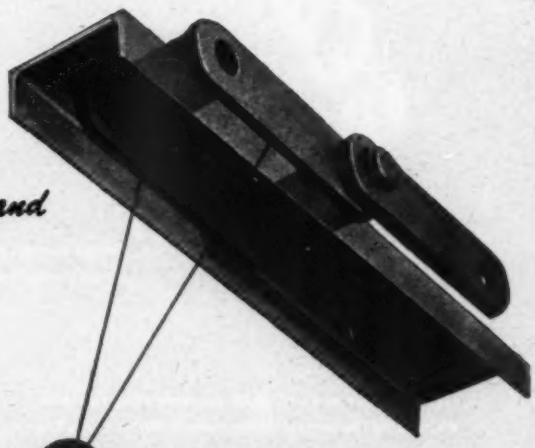


19.7 SQ. IN. of actual sliding surface per foot of PW 132 chain

13.6 SQ. IN. of actual sliding surface per foot of ordinary No. 132 chain



Return Strand



20.2 SQ. IN. of actual sliding surface per foot of PW 132 chain

5.6 SQ. IN. of actual sliding surface per foot of ordinary No. 132 chain

No. 1226 Chain also available in PW type

JEFFREY

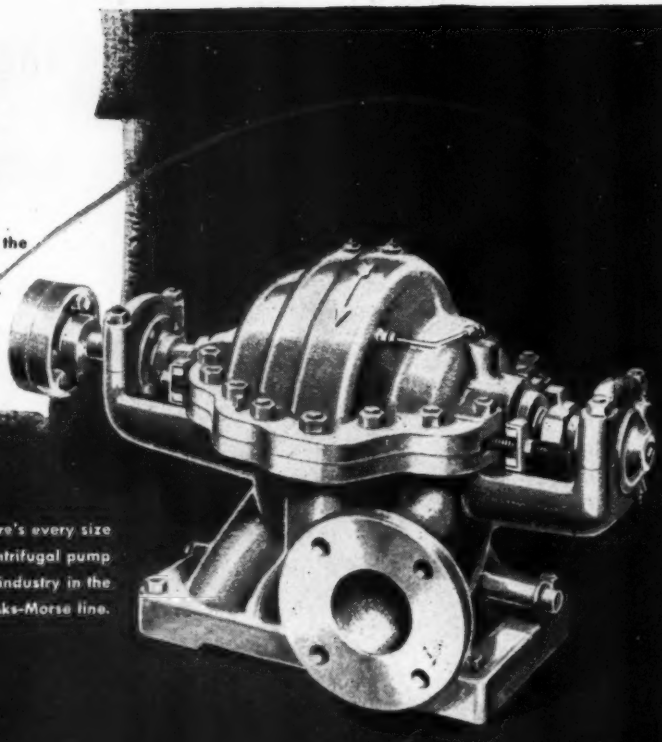
Established in 1877

JEFFREY PRODUCTS
Belt Conveyors
Pan Conveyors
Trippers (belt cable)
Elevators (bucket)
Feeders (flume, belt, cable)
Car Haulages
Portables
Scalpers
Shredders
Locomotives (Storage)

THE JEFFREY MANUFACTURING COMPANY
210-99 North Fourth Street, Columbus 16, Ohio
Sales Offices in Principal Cities

Can ANYONE make a Pump?

Well, there's no law against it—except perhaps the "law of survival." It's a question of what *kind* of pump you want—and how *good* you want it to be. If you want a pump that will squeeze the last fraction of a cent in value out of the monthly power bill, that is designed to the very limits of hydraulic knowledge—built with the fine tools and complete facilities that such precision design requires—you'll want a Fairbanks-Morse pump.



There's every size and type of centrifugal pump used in industry in the Fairbanks-Morse line.

Westco pumps: precision-built, broad in application.

WHEN YOU BUY a Fairbanks-Morse, Pomona or Westco pump, you get a design which is the result of accumulated years of research in not only our own laboratories but those of the universities' scientists whom we have retained.

For all vertical turbine pump work—the Pomona line.

THIS DESIGN and unlimited manufacturing facilities, which only the largest pump manufacturers can offer you, combine to give you pumps superior in performance and reliability.

ANYONE CAN MAKE A PUMP—perhaps! But for *proved* value, *skilled* service—regardless of the type of pumping requirements or the amount of liquid to be moved—Fairbanks-Morse is an unquestioned leader. Call your nearest Fairbanks-Morse distributor or branch office.

FAIRBANKS-MORSE

A NAME WORTH REMEMBERING

PUMP DIVISION

COOPER'S 25 YEARS

. . . and what they mean to users of Stainless Steel Castings

The quarter century spent by Cooper in specialized study of stainless steel castings is strongly reflected in the company's ability to produce sound castings—and to give equally sound advice on their application. Over such a long period, it was inevitable that this ability of Cooper's to produce a superior product would become known to industry everywhere—with the natural result that Cooper's business growth has been phenomenal.

To you, as a user of stainless steel castings, Cooper's 25 years—and Cooper's present size—represent important values not elsewhere available.

Cooper's quarter century gives you the benefit of an experience dating from the earliest days of chromium-iron castings in this country—an experience that sweeps through the multitude of developments in casting techniques, metallurgical controls and inspection with X-rays, Gamma rays and Ultra Violet rays—an experience embracing the inception of and continued improvements in machine molding, sand control, heat treatment, centrifugal casting and machining methods.

Cooper's size—it's the largest exclusive stainless steel foundry in the country—gives you an added measure of experience—breadth. The organization is large enough to include, as it does, *all* the highly specialized knowledge required to give you the best in castings and the best advice on their application.

Whenever you need stainless steel castings, we sincerely believe it will pay you to get in touch with Cooper.

THE COOPER ALLOY FOUNDRY CO.

125 Bloy Street, Hillside, N. J.

CA-108

It's the REASON for this Fact that's important

Your *Standard* GATES VULCO ROPES

Are Today **OUT-PERFORMING** Any V-Belts Ever Built Before

Early in the war it was found that no V-belts then being built by anyone could stand the combat-service requirements of the Army's tanks, tractors, and self-propelled big guns. For this unprecedented severity of service, Gates developed and built V-belts far stronger and more durable than any V-belts ever built before—and here is why this fact is NOW important to YOU:—

HERE is the reason

✔ **Every improvement developed by Gates for these Army V-belts has also been added, day by day, to the quality of the standard Gates Vulco Ropes which have been delivered to you.**

Here is one of the very few instances in which improvements developed primarily for military use were passed on immediately to you. Ordinarily, that could not be done. Gates V-belts were made an exception because it was recognized that industry needed the best possible V-belts in order to achieve the greatest possible production—and maximum production was one of the nation's vital needs.

That is why Gates has been able to pass on to you, day by day, every V-belt improvement developed for our armed forces during the war—and that is why your Standard Gates Vulco Ropes are today outperforming any V-belts ever built before!

All Gates V-Belts are Built With *The Patented* CONCAVE SIDE

Gates

THE MARK OF SPECIALIZED RESEARCH

THE GATES RUBBER COMPANY

Engineering Offices and Jobber Stocks in All Large Industrial Centers

482

GATES VULCO ROPE DRIVES

CHICAGO 6, ILL., 549 West Washington. NEW YORK CITY 3, 215-219 Fourth Avenue. ATLANTA 3, GA., 521 C. & S. Nat'l Bank Bldg.
LOS ANGELES 21, CAL., 2240 E. Washington Blvd. DENVER 17, COLO., 999 S. Broadway. DETROIT 2, MICH. 223 Boulevard Bldg.
PORTLAND 9, ORE., 333 N.W. 5th Ave. DALLAS 2, TEXAS, 1710 N. Market St. SAN FRANCISCO 3, CAL., 170 Ninth St.

CALL ON WHITTAKER

for minerals, colors and pigments from A to Z

Perhaps you know Whittaker as a quality source of one or two materials. Good! Many do. But many more are learning that the same high Whittaker quality is available in a wide range of other minerals, colors and pigments, too.

You can place your order for commercial quantities of *any* Whittaker product with the same confidence. Every one of them is "engineered" to laboratory standards. Uniformity and quality of product are strictly controlled by thorough tests for particle size, purity, weight and color – your assurance that Whittaker minerals, colors and pigments will perform properly in your product or process.

Write for detailed product data laboratory samples, or help and information from the Whittaker technical staff.

203

ALBATEX
ALUMINUM SILICATE
ALUMINUM STEARATE
ANTIMONY SULPHIDE
ASBESTOS
ATOMITE
BARIUM SULFATE
BARYTES
BENTONITE
BLACKS
BLANC FIXE
BLUE
BORAX
BORIC ACID
CALCITE
CALCIUM CARBONATE
CALCIUM HYDROXIDE
CALCIUM OXIDE
CALCIUM STEARATE
CALCIUM SULFATE
CASEIN
CHALK
CLAYS
CLIFFSTONE WHITING
COLORS
CORN DEXTRINE
CORN STARCH
COSMETIC COLORS
CROCUS MARTIS
CHROMIUM OXIDE GREEN
DENTAL PLASTER
DIATOMACEOUS EARTH
EARTH COLORS
EARTHS
FELDSPAR
FIBROUS TALC
FILTER AIDS
FILTERING EARTHS
FLINT
FLUORSPAR
FORMALDEHYDE DUST
FOSSIL FLOUR
FULLERS EARTH
GRAPHITE
GREEN HOUSE SHADING
GROUND GLASS
GYPSUM
HYDRATED LIME
HYDRO MAGMA
INFUSORIAL EARTH
IRON OXIDE
KAOLIN
KIESELGUHR
LIME
LIMESTONE
LITHARGE
LITHOPONE
MAGLITE
MAGNESITE
MAGNESIUM CARBONATE
MAGNESIUM HYDROXIDE
MAGNESIUM OXIDE
MAGNESIUM SILICATE
MAGNESIUM STEARATE
MAGNESIUM TRISILICATE
MARBLE
MARBLE CHIPS
MICA GROUND
NON-SLIP CHIPS
OCHRE
OPTICAL ROUGE
ORTHOPEDIC PLASTER
PARIS WHITE
PLASTER PARIS
PLUMBAGO
PUMICE STONE
PUTTY POWDER
PYRPHYLLITE
QUARTZ
RED OXIDE
RICH STARCH
ROTTENSTONE
ROUGE
SERICITE
SIENNAS
SILEX
SILICA
SLATE
SOAPSTONE
SOAPSTONE CRAYONS
SOLAR SHADE
STEARATES
STEATITE
STEARIC ACID
TALC
TALC CRAYONS
TERRA ALBA
TERRAZZO STRIPS
TIN OXIDE
TITANIUM DIOXIDE
TRIPOLI
UMBERS
VENETIAN RED
VIENNA LIME
VOLCANIC ASH
VOLCLAY
WHITING
YELLOW OXIDE
ZINC OXIDE
ZINC STEARATE

WHITTAKER

EST. 1890

Whittaker, Clark & Daniels, INC.

260 West Broadway, New York 13, N. Y. • Plant: South Kearny, New Jersey

SALES REPRESENTATIVES

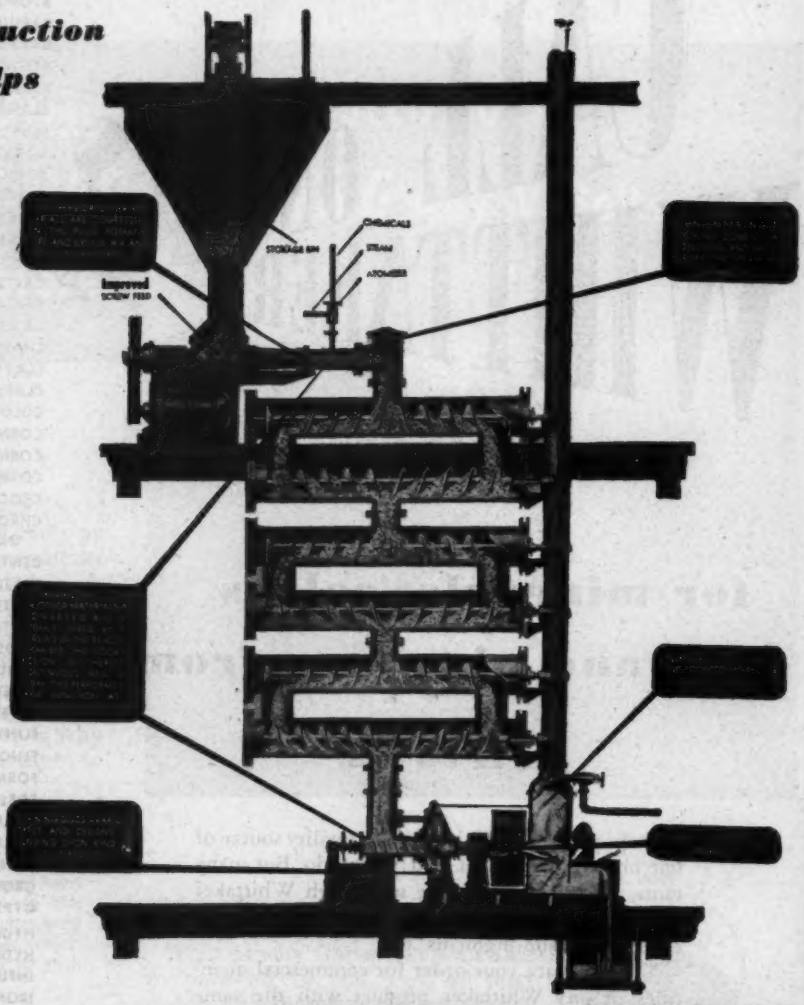
CHICAGO Harry Holland & Son, Inc.	MEMPHIS, TENN. L. E. Cliett Co.
PHILADELPHIA R. Peltz Company	CLEVELAND Palmer Supplies Co.
NEW ORLEANS E. W. Ortenbach	TORONTO & MONTREAL Richardson Agencies, Ltd.

B-K REACTION CHAMBER

Patented and Patents Pending

Shown in combination with the Asplund Defibrator

For Continuous Production of Semi-Chemical Pulps



The B-K Reaction Chamber produces fibres for the manufacture of: (1) insulating (soft) board, hard board; (2) roofing and flooring felts; (3) special fibres for industrial uses such as bulk insulation, plastics, etc., and (4) semi-chemical pulps for the manufacture of paper and paper board.

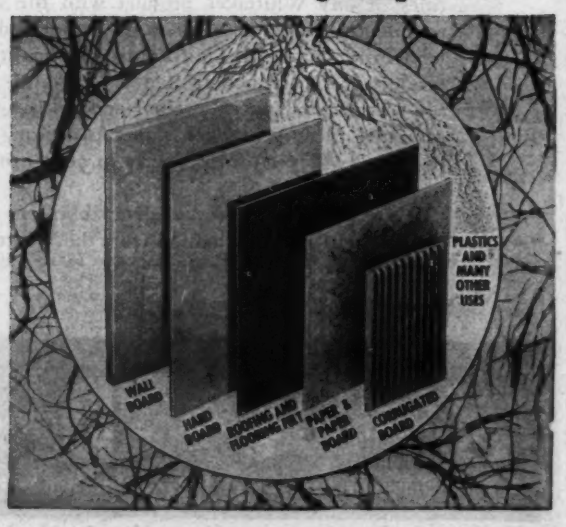
The fibres and semi-chemical pulps are produced from any specie of coniferous and deciduous wood, and the **B-K Reaction Chamber** process is especially adapted to the utilization of wood waste, straw, bagasse, and other cellulosic materials.

The B-K Reaction Chamber is made in units and the number of these can be varied according to the degree of treatment required.

High pulp yield with low power consumption.

A Pilot plant and our Laboratory facilities for test runs are available.

Full Particulars in new, descriptive Bulletins. Write for copy.



PAPER and INDUSTRIAL APPLIANCES
Incorporated
122 East 42nd Street, New York, N. Y.

R

46

BLEACHED SULPHITE PULP manufactured by the Pulp Division, Weyerhaeuser Timber Company is a quality product made of West Coast pulpwood harvested from Weyerhaeuser timberlands.

WEYERHAEUSER

STANDARD
APPLETON
FELTS.
AMERICAN WOOL
AMERICAN LABOR
AMERICAN FELTS
APPLETON, WIS.
make
APPLETON FELTS
good
paper
Appleton Woolen Mills
APPLETON • WISCONSIN

946

THE MORE YOU LOOK THE MORE NEW IDEAS YOU SEE IN THIS CYANAMID MELAMINE PAPER RESIN

PAREZ** RESIN 607 offers growing opportunity to paper manufacturers seeking ways to endow their products with new sales features.

And PAREZ is simple and economical to use. Added to your regular paper manufacturing processes—it imparts exceptional wet and dry strength, improved tensile and bursting strength, plus folding endurance. Such added qualities will help your paper products do old jobs better and also many entirely new jobs.

Paper manufacturers will do well to investigate this war-proved, stronger and tougher melamine paper resin—for PAREZ 607 undoubtedly offers an *opportunity that just grows and grows.*

TELEGRAM
This Is An Invitation!
Bring your problems on new paper product developments and product improvements to the TAPPI meeting where members of the CYANAMID TECHNICAL SERVICE STAFF will be on hand to assist you.

American Cyanamid & Chemical Corporation

(A Unit of American Cyanamid Company)

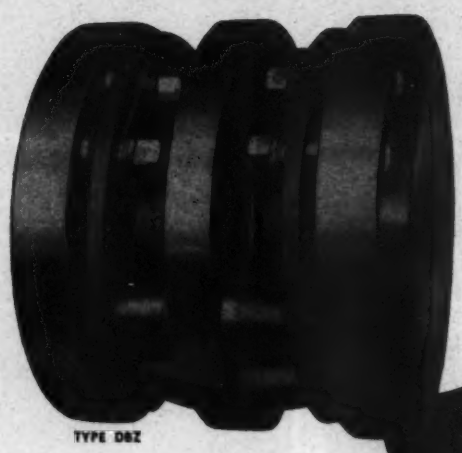
30 ROCKEFELLER PLAZA • NEW YORK 20, N. Y.

DISTRICT OFFICES: Boston, Massachusetts; Philadelphia, Pennsylvania; Baltimore, Maryland; Charlotte, North Carolina; Cleveland, Ohio; Chicago, Illinois; Kalamazoo, Michigan; Detroit, Michigan; St. Louis, Missouri; Azusa, California; Seattle, Washington. In Canada: Dillons Chemical Company, Ltd., Montreal and Toronto.

****Trade-mark of American Cyanamid & Chemical Corporation covering its synthetic resins for use by the paper industry. The processes under which PAREZ is applied in the production of wet strength paper are covered by U.S. Patents Nos. 2,291,079, 2,291,080 and 2,345,543 and U.S. Patent Application Serial No. 433,032.**

THOMAS *Flexible* COUPLINGS

. . . proven to be 100% dependable on wood choppers, centrifugal pumps and other heavy duty machinery in the paper manufacturing industry



TYPE DBZ

Today's modern high-speed paper manufacturing machinery requires couplings with all the important features built into the couplings designed by Thomas Engineers.

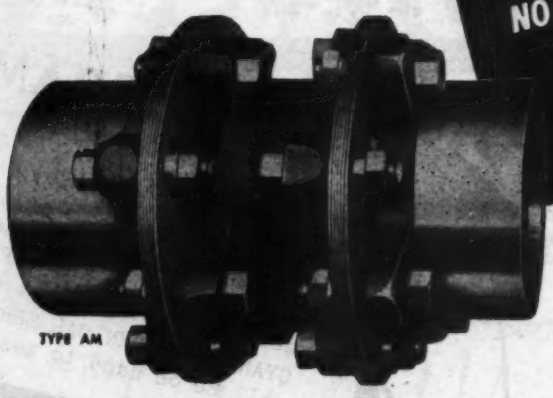
Thomas Couplings are in perfect balance under all conditions of misalignment.

BACKLASH, FRICTION, WEAR and CROSS-PULL ARE ELIMINATED

NO LUBRICATION IS REQUIRED!

Torsional characteristics remain constant regardless of length of service.

The Longer Life of Thomas Flexible Couplings, without costly interruptions and replacements will add much to Your Operating Profits!



TYPE AM

Thomas All-Metal Flexible Couplings do not depend on springs, gears, rubber or grids to drive. All power is transmitted by direct pull.

Write for our Complete Engineering Catalog!

THOMAS FLEXIBLE COUPLING COMPANY

WARREN, PENNSYLVANIA

HERE'S another example of the skill of Flori's master pressure welders:

Propane gas storage tank, 24" o.d. by 14'0" long, welded under ASME Power Boiler Code, Hartford inspected. Designed to withstand propane gas, 100 P.S.I. W.P. at 150° F. Six gauge outlets.

Flori-Welding is your assurance of highest craftsmanship and unquestioned dependability in the toughest kinds of service.

IF IT'S FABRICATION
...CONTACT FLORI

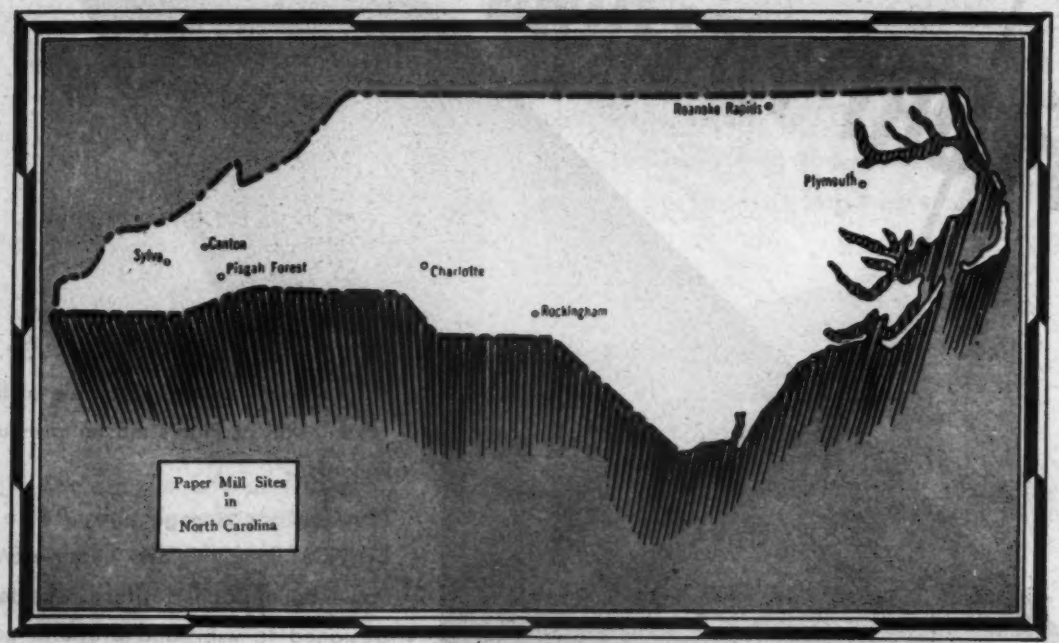
FLORI
FABRICATION

THE FLORI PIPE COMPANY • ST. LOUIS 15 • CHICAGO 47

Draper's

ATLAS OF AMERICAN PAPERMAKING

No. 14 PUBLISHED BY DRAPER BROTHERS COMPANY · CANTON, MASSACHUSETTS



Map copyright by L. D. Post, Inc., New York, N. Y. American Map Co., New York, N. Y.

HIGH LIGHTS: North Carolina, through a subsidy by its Provincial Congress of 250 pounds sterling, launched its first paper mill near Hillsboro in 1777. The paper industry south of the Mason-Dixon line was slow to develop. There were but fifteen paper mills among the States which seceded in 1861, estimated to have a total daily capacity of not over 75 tons. The daily capacity of all North Carolinian mills is now estimated to be about 900 tons and the State rates 21st in production among the 36 paper producing States of the Union.

North Carolina is distinguished historically in the paper industry as one of the first two States to make sulphate pulp. This occurred at Roanoke Rapids on February 26, 1909, when the Roanoke Rapids Manufacturing Company blew its first digestor. The latest development of importance in the State has been the establishment of the Ecusta Paper Company, in 1938, to manufacture cigarette and other light weight specialties from native-grown flax straw.

Paper mill equipment in North Carolina includes 15 Fourdriniers, and 7 cylinder machines.

Draper Felts for Efficiency

DRAPER BROTHERS COMPANY

Woolen Manufacturers Since 1856

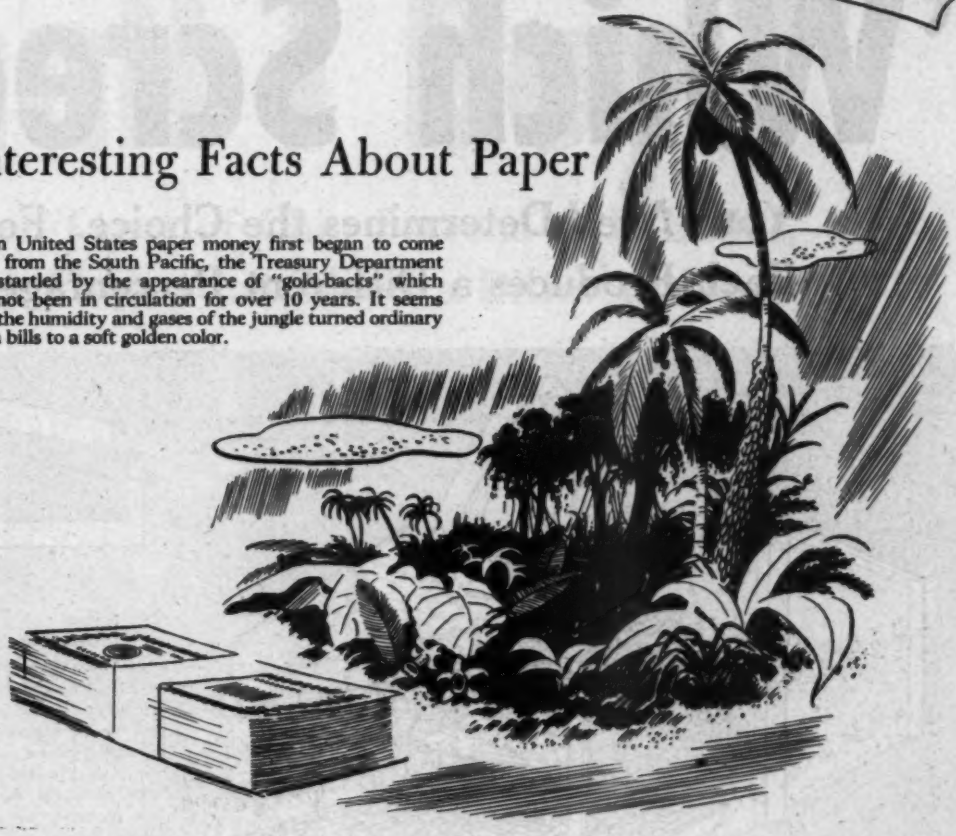
Canton, Massachusetts

RALPH E. BRIGGS Sales Manager

BRADFORD WEST PITTSFIELD, MASS. · WILLIAM N. CONNOR Jr CANTON, MASS. · L. H. BREYFOGLE KALAMAZOO, MICH. · CHAS. E. BERTSCHY MILWAUKEE, WIS. · W. L. CAMPBELL SAVANNAH, GA. · BALFOUR GUTHRIE & CO. Ltd. PACIFIC COAST

Interesting Facts About Paper

When United States paper money first began to come back from the South Pacific, the Treasury Department was startled by the appearance of "gold-backs" which had not been in circulation for over 10 years. It seems that the humidity and gases of the jungle turned ordinary green bills to a soft golden color.



● Interesting Facts About Methylene Blue

Methylene Blue 2B Conc. is a clear, greenish, Basic Blue. It possesses good solubility and is suitable for all types of coloring—beater, calender, and coating.

It is extensively used on kraft, tissue, boxboard, wrapping, and poster paper to produce shades varying from light blues and grays to deep and medium blues. It is used on both sized and unsized papers.

Complete information on Methylene Blue 2B Conc. is available from your Heller & Merz representative on request.

Heller & Merz Department

CALCO CHEMICAL DIVISION . AMERICAN CYANAMID COMPANY

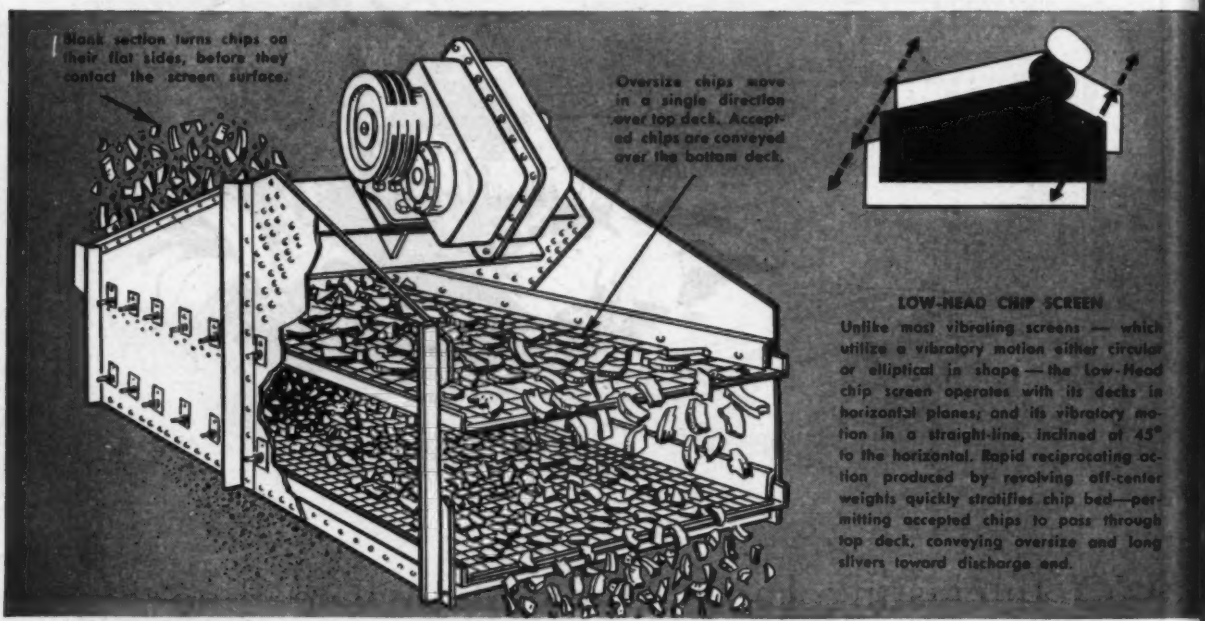
BOUND BROOK, NEW JERSEY

New York • Chicago • Philadelphia • Boston • Charlotte • Providence

Calco

"Which Screen

Your *Need* Determines the Choice. For, of the Each Produces a Different Percentage of Uni-


Blank section turns chips on their flat sides, before they contact the screen surface.
Oversize chips move in a single direction over top deck. Accepted chips are conveyed over the bottom deck.

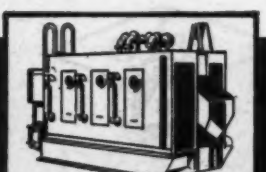
LOW-HEAD CHIP SCREEN

Unlike most vibrating screens — which utilize a vibratory motion either circular or elliptical in shape — the Low-Head chip screen operates with its decks in horizontal planes; and its vibratory motion in a straight-line, inclined at 45° to the horizontal. Rapid reciprocating action produced by revolving off-center weights quickly stratifies chip bed—permitting accepted chips to pass through top deck, conveying oversize and long slivers toward discharge end.

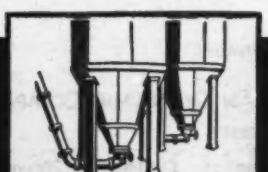
ALL CHIP SCREENS ARE NOT ALIKE—not in the *quality* of chips they produce; not in their *operation*; not in the *space* they take!

And that's one of the reasons A-C offers you *two* different types of chip screens from which to select—each designed to fit a *different* mill requirement. For example—A-C's "Low-Head" screen gives you the *highest percentage* of uniform size, clean chips . . .

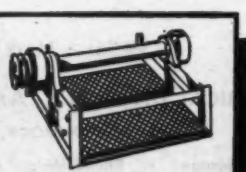
"LOW-HEAD" SCREEN ALSO GIVES YOU *closer separation* than any comparable chip screen on the market! Secret is in its *motion*—chips are moved in a *single direction,* on their *sides.* Result: long slivers will not turn on edge and lodge in screen openings—greatly reducing need for sliver removal. And "Low-Head" operates horizontally, takes *less headroom*—saves on installation or modernization cost.



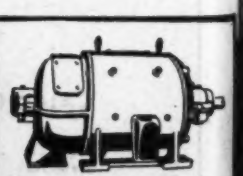
PREPARATION — Hydraulic Barkers, Chip Screens, Saws, Slashers, Interplane Grinders.



COOKING — Digesters, Blow Tanks, Kilns, Slakers, Heat Exchangers, Condensers.



WET ROOM — vibrating-type screens for use as Thickeners, for dewatering rejects.

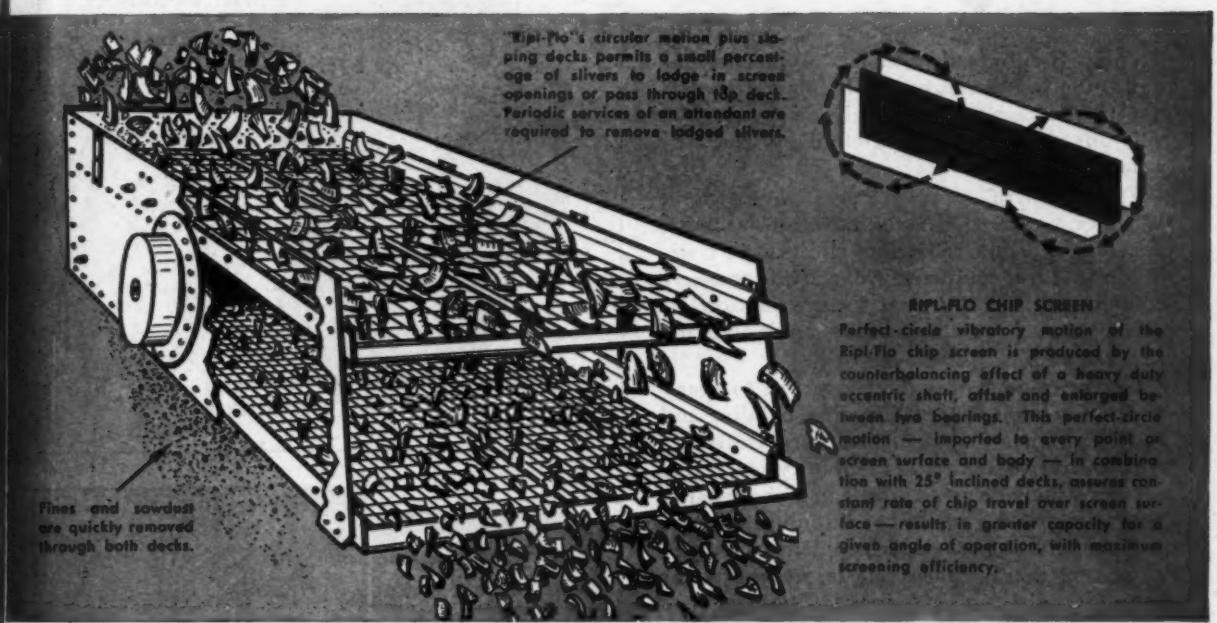


PAPER-MAKING — special design Drives for Paper Machines, Rewinders, Calenders.

ALLIS CHALMERS

Shall I Buy?"

2 Distinct Types of Chip Screens A-C Builds, form Size Chips—thus Meets a Different Need!

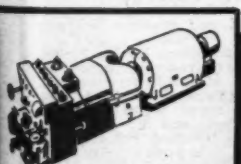

"Ripl-Flo"'s circular motion plus sloping decks permits a small percentage of slivers to lodge in screen openings or pass through top deck. Periodic services of an attendant are required to remove lodged slivers.
Fines and sawdust are quickly removed through both decks.
RIPL-FLO CHIP SCREEN
Perfect-circle vibratory motion of the Ripl-Flo chip screen is produced by the counterbalancing effect of a heavy duty eccentric shaft, offset and enlarged between two bearings. This perfect-circle motion — imparted to every point on screen surface and body — in combination with 25° inclined decks, assures constant rate of chip travel over screen surface — results in greater capacity for a given angle of operation, with maximum screening efficiency.

NEED JUST AVERAGE SCREENING EFFICIENCY? A-C's "Ripl-Flo" chip screen (above) will give you an *average percentage* of uniform size chips. Its motion—like that of *any* inclined screen—permits a limited number of slivers to turn on edge and lodge in screen openings. These slivers require periodic removal. For many grades of pulp, however, "Ripl-Flo" proves entirely satisfactory. One reason . . .

"RIPL-FLO" SCREEN DOES AS GOOD or *better* screening job than any inclined screen! It is a low-price screen—uses only 2 bearings in its design. Saves on power—lowers maintenance over conventional 4-bearing screens.

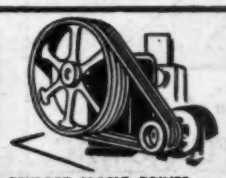
For more information on A-C chip screens, plus screening "Questionnaire", call our nearby district office, or write for Bulletin B6353. ALLIS-CHALMERS, MILWAUKEE. A1963

HEAR THE BOSTON SYMPHONY: *Saturday, American Broadcasting Co.*

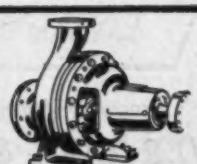


POWER — all types of Power Generation, Distribution and Control Equipment.

MOTORS & CONTROLS — all types a-c and d-c Motors, ½ to 7000 hp — Gearmotors.



TEXROPE V-BELT DRIVES — fractional to 5000 hp — Constant and Adjustable speed.



PUMPS — Single & Multi-Stage, 10 to 150,000 gpm — Paper Stock Pumps, Fan Pumps.

MILWAUKEE 1, WIS.

OPERATE WITHOUT CONDITIONED WATER?

You Couldn't Do it!

Properly conditioned water is absolutely essential to the paper industry. It is imperative that paper mills have the right equipment . . . to provide this conditioned water efficiently and economically.

That's where Graver enters the picture. Whether the job calls for removal of hardness, deaeration, demineralization, filtration or clarification, Graver equipment will provide properly conditioned water to meet the specific job requirements . . . regardless of the condition of the raw water.

Graver equipment is the product of 34 years' experience in the field of designing, building and installing water treating units of all types. Graver *complete service* starts with laboratory analysis of the raw water and carries through to the installation of the entire water conditioning unit . . . right down to your superintendent's final approval. Graver assumes full responsibility for the entire job.

No matter what your water conditioning problem is . . . you'll find it to your advantage to consult Graver. We'll gladly discuss these problems with you and supply detailed information and illustrated bulletins. Write us today.

GRAVER
WATER CONDITIONING EQUIPMENT

Process Equipment Division of

GRAVER TANK & MFG. CO., INC.

General Offices: 4809-87 Tod Ave., East Chicago, Ind.

NEW YORK CHICAGO CATASAUQUA, PA. TULSA, OKLA.
PHILADELPHIA PORT ARTHUR, TEX.

Hot Process Water Softeners • Zeolite Water Softeners
Water Filters • Taste and Odor Removal Filters • Iron Removal Filters • Oil Removal Filters • Chemical Mixing and Proportioning Equipment • Demineralizers

Here's Money-Saving Protection For Your Compressed Air Operated Machinery and Instruments

Now, regardless of volumes required or fluctuating pressures, the new Bird-White Pur-O-fiers completely and effectively remove all moisture, oil, dirt and other foreign matter from compressed air or gas lines—preventing costly corrosion and gumming in compressed air-operated machinery and instruments.

Operating on the principle of centrifugal action, a high speed Turbo-rotor forces the tiny particles of foreign matter outward where they are trapped and drained off.

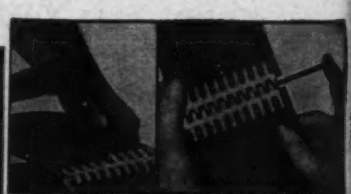
Single units can accommodate up to 100 cubic feet. Above this range multiple units are recommended.

New applications for Bird-White Pur-O-fiers are being developed every day. Write for Bulletin No. 10 giving complete information.

BIRD-WHITE COMPANY
Dept. PI, 3119 W. Lake Street
Chicago 12, Illinois

PATENTED

BELT LACING and FASTENERS for transmission and conveyor belts



"JUST A HAMMER TO APPLY IT"

ALLIGATOR

Trade Mark Reg. U. S. Pat. Office

STEEL BELT LACING

World famed in general service for strength and long life. A flexible steel-hinged joint, smooth on both sides. 12 sizes. Made in steel, "Monel Metal" and non-magnetic alloys. Long lengths supplied if needed. Bulletin A-60 gives complete details.

FLEXCO HD

BELT FASTENERS AND RIP PLATES

For conveyor and elevator belts of all thicknesses, makes a tight butt joint of great strength and durability. Compresses belt ends between toothed cupped plates. Templates and FLEXCO Clips speed application. 6 sizes. Made in steel, "Monel Metal", non-magnetic and abrasion resisting alloys.

By using Flexco HD Rip Plates, damaged conveyor belting can be returned to satisfactory service. The extra length gives a long grip on edges of rip or patch. Flexco Tools and Rip Plate Tool are used. For complete information ask for Bulletin F-100.

Sold by supply houses everywhere

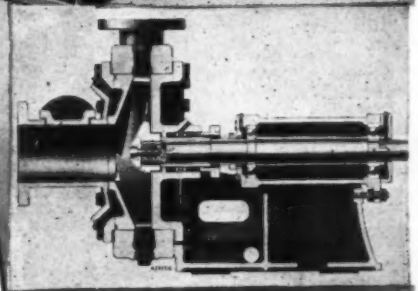
CONVEYOR BELTS EASILY FASTENED

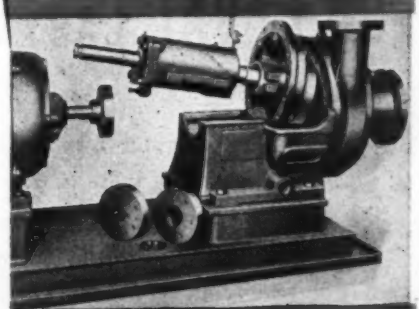
FLEXIBLE STEEL LACING CO.

4606 Lexington Ave.
Chicago 44, Ill.

STOCK PUMPS

For Blow Pit . . . Bull Screen . . . Brown Stock . . . High Consistency Dockered Stock . . . Heavy Bleached Stock . . . Broke . . . Machine Feed . . . Couch Pit, etc.





It takes good tough pumps to do the many stuff-toting jobs in a paper mill. Cameron horizontal stock pumps are tough —they stay on the job and they are easily serviced if that becomes necessary.

The casing is heavy . . . it won't crack; it won't corrode through . . . it is good for the life of the pump.

Impellers are straight sided with rounded leading edges . . . This prevents chips from catching between the shroud and impeller vanes.

Adjustment for wear . . . A single easily accessible bolt moves the impeller forward to compensate for wear. The shroud is renewable.

Dismantling is easy . . . The entire rotor and pump backhead may be removed without disturbing the driver or the piping.

Let an I-R engineer tell you more about these stock pumps, about our vertical stock pumps, or about other pumps for pulp and paper mills. Ask for your copy of Bulletin 7022 covering our complete line of such pumps. Ingersoll-Rand Company, Cameron Pump Division, 11 Broadway, New York 4, N. Y.

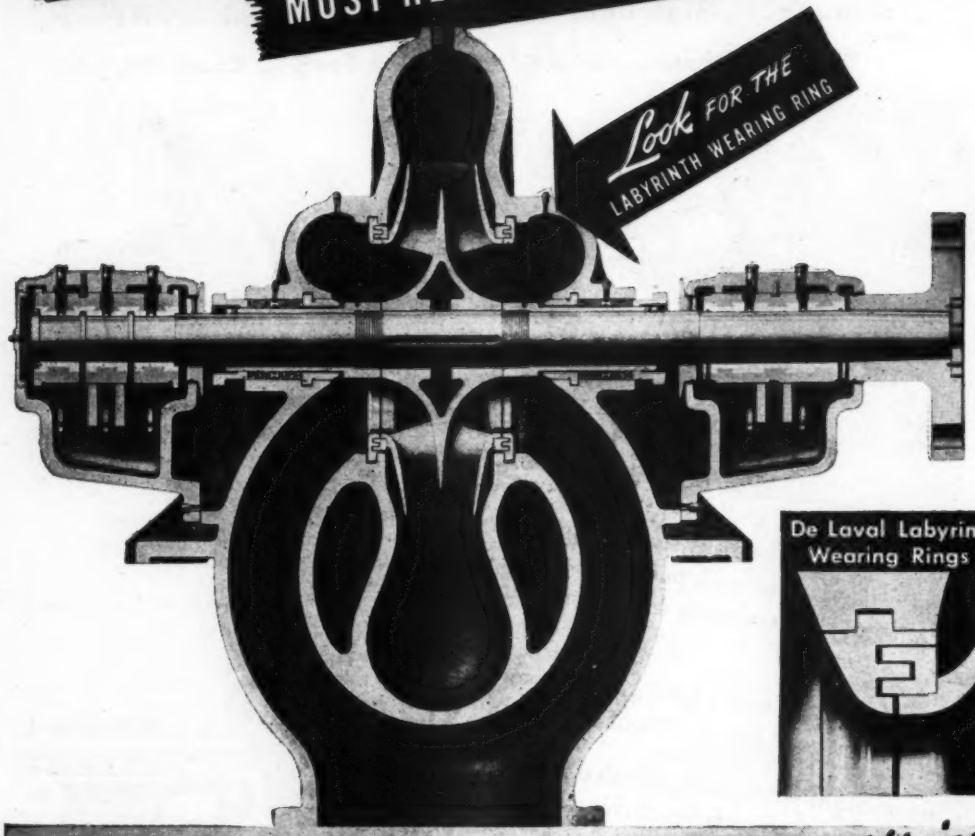
Ingersoll-Rand

COMPRESSORS · AIR TOOLS · ROCK DRILLS · TURBO BLOWERS · CONDENSERS · CENTRIFUGAL PUMPS · OIL AND GAS ENGINES

THE PUMP YOU BUY *TODAY*

MUST HELP MEET COMPETITION *TOMORROW*

Look FOR THE LABYRINTH WEARING RING



DE LAVAL LABYRINTH RINGS *keep efficiency UP cost DOWN*

De Laval Labyrinth Wearing Rings minimize leakage from discharge back to suction. The sealing action of these rings is accomplished by the use of large clearance, tortuous labyrinth passages and does not depend upon close mechanical clearances, such as required for plain flat rings. Because of the larger clearances and reduced flow, the effectiveness of the De Laval labyrinth ring is but little diminished by wear, resulting in sustained efficiency for long periods. When selecting pumps for lowest ultimate cost, look for the De Laval Labyrinth Wearing Ring.

3237

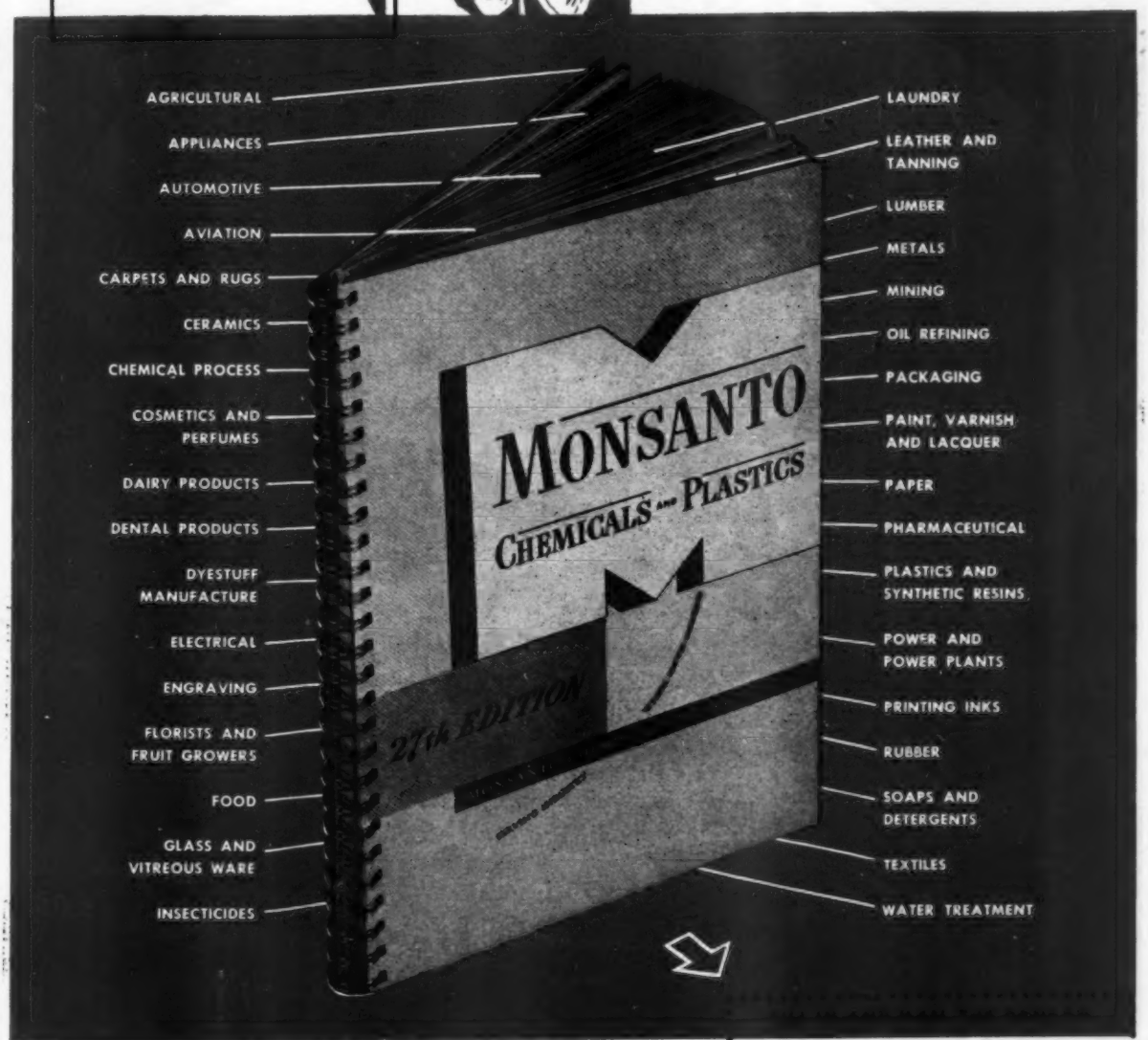
TURBINES · HELICAL GEARS
WORM GEAR SPEED REDUCERS
CENTRIFUGAL PUMPS · CENTRIFUGAL BLOWERS and COMPRESSORS · IMO OIL PUMPS

DE LAVAL

STEAM TURBINE COMPANY · TRENTON 2, NEW JERSEY

SALES OFFICES: ATLANTA · BOSTON · CHARLOTTE · CHICAGO · CLEVELAND · DENVER · DETROIT · HELENA · HONOLULU · HOUSTON · KANSAS CITY · LOS ANGELES · MANILA · MONTREAL · NEW HAVEN · NEW ORLEANS · NEW YORK · PHILADELPHIA · PITTSBURGH · ROCHESTER · ST. PAUL · SALT LAKE CITY · SAN FRANCISCO · SEATTLE · TORONTO · TULSA · VANCOUVER · WASHINGTON, D.C. · WINNIPEG
And Cities in Central and South America

NEW and now available



If you are identified with any of the above 34 industries, this new and complete Monsanto Catalog should be on your desk . . . It contains 214 pages of valuable, detailed information on more than 400 Monsanto Chemicals and Plastics — a daily guide of definite help to everyone whose thinking is geared to increased production, greater economies, better methods and improved product salability . . . Send for your copy today . . . Fill in and mail the coupon, or write MONSANTO CHEMICAL COMPANY, 1700 South Second Street, St. Louis 4, Missouri.

MONSANTO CHEMICAL COMPANY
Department 26-A
1700 South Second Street
St. Louis 4, Missouri

Please send immediately copy of your new Monsanto Catalog to

*Name*_____

*Title*_____

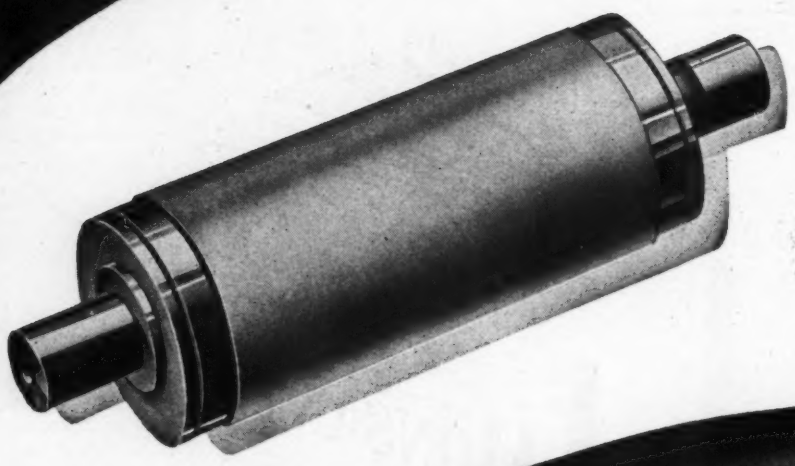
*Company*_____

*Street*_____

*City*_____ *Zone*____ *State*_____

PERKINS RESEARCH

keeps pace with INDUSTRIAL PROGRESS

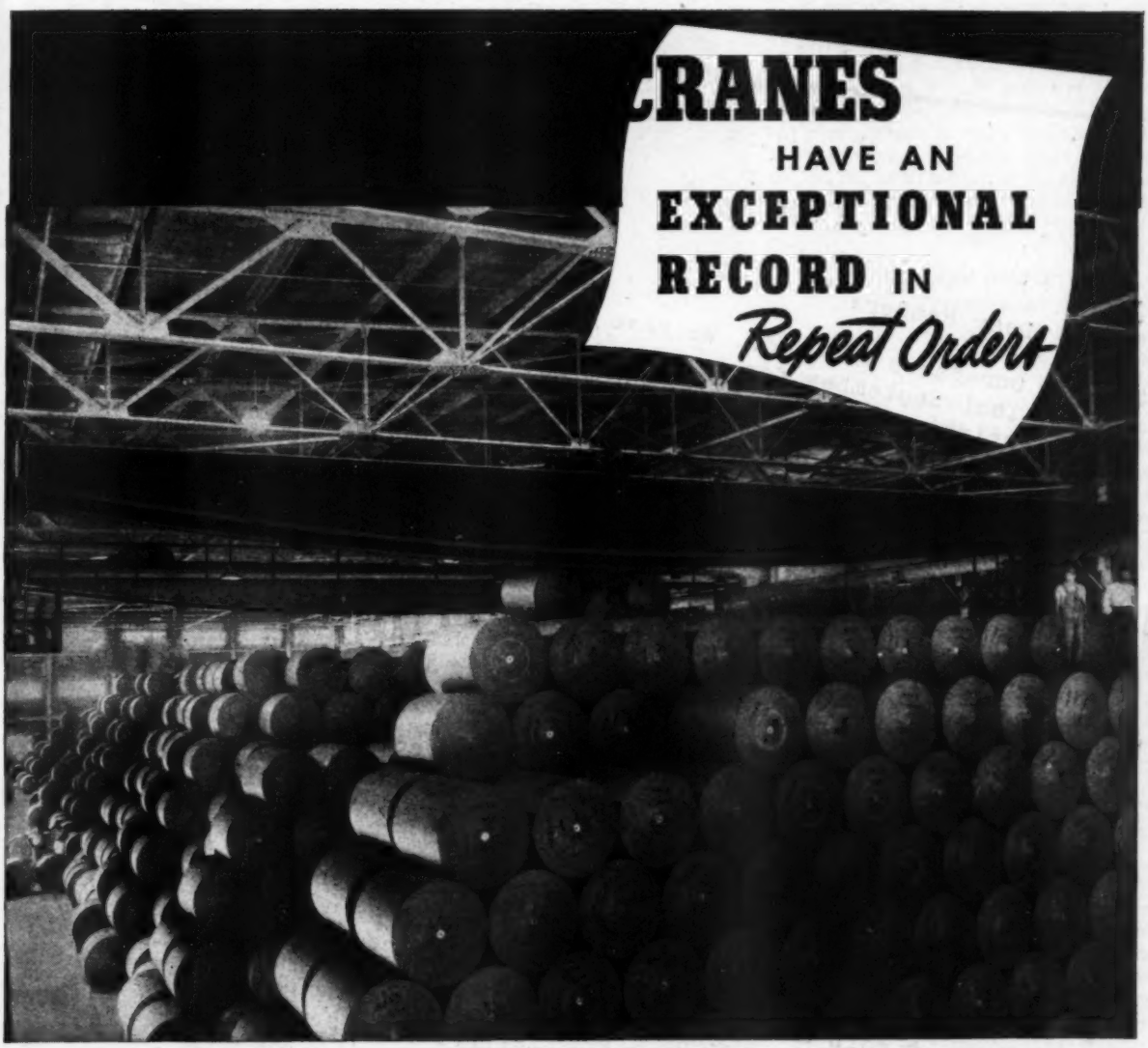


PERKINS

CALENDER ROLLS

B. F. PERKINS & SONS, INC.

HOLYOKE · MASSACHUSETTS



Years of Experience With Paper Mill Cranes and Hoists

For years Northern has designed and built overhead cranes of all kinds especially for the paper industry. We have furnished handling equipment to the majority of the large mills throughout the United States and Canada. This wide experience has resulted in the development of cranes and hoists built particularly to suit the industry's needs.

Northern Cranes and Hoists are furnished to handle any load, with speeds, lift, span, etc. to suit your requirements.

Many paper mills are regular purchasers—have large numbers of Northern Cranes and Hoists in operation.

Repeat business of this sort is obtained only by the very highest quality—the type of quality built into Northern Cranes.

WRITE FOR BULLETIN

NORTHERN ENGINEERING WORKS

General Offices: 2625 ATWATER ST.
DETROIT 7, MICH.

HEAVY DUTY CRANES • LOW HEADROOM CRANES
BUCKET CRANES • TRANSFER CRANES • ELECTRIC
HOIST CRANES • HAND CRANES • ELECTRIC HOISTS
AIR HOISTS • SPECIAL CRANES AND HOISTS

Dear Reader:

Our faces are red. We have been apologizing since last September for a situation in the Chicago printing industry which culminated in a month-long strike last October that caused this magazine to be set back six weeks from its regular publishing date of the September issue. Production slowdowns due to shortage of union manpower and the withdrawing of overtime privileges, both before and after the strike was ended, have prevented us as yet from overcoming this handicap.

Possibilities of reducing this timelag in our publishing date are now becoming visible. To hasten it, we are doing everything that we can to assist the printer.

In this issue it will be seen that some of our regular departments have been omitted. News items of far-reaching and major importance have been confined largely to the section of Trade Winds which begins on the opposite page. Educational articles, abridgments of convention papers, and items on production and maintenance -- all covering wide and diversified interests in the manufacture of pulp and paper -- appear in this issue as usual. The arrangement of reader and advertising pages, however, has been changed temporarily to some extent.

All of our readers and advertisers have been infinitely patient and kind in the difficulties we have encountered. We are grateful for this, and we are confident that soon we shall be able to serve them again in the month that the magazine is dated.

Sincerely,

Fritz Publications, Inc.

Trade Winds

WATER FILTRATION PLANT UNDER CONSTRUCTION AT BRYANT PAPER COMPANY

A water filtration plant, with a daily capacity of 8,000,000 gallons, is being built by the Bryant Paper Company (subsidiary of Time Inc.), at Kalamazoo, Michigan. The new plant will be in operation before midsummer, according to Merton S. Fogerty, vice president in charge of engineering.

In making the announcement, Allan B. Milham, Bryant president, stated that the company's greatly expanded operations, especially in view of the heavy demands the new coating mill will make, made it necessary to seek an added water supply. Accordingly, the company bought property along Portage creek, a mile south of the plant, is installing a pump house there, and will obtain water there for the new filtration plant.

This move was made, instead of drilling more deep wells on the property, because the strata from which its water is now obtained is the same from which the City of Kalamazoo gets its supply. In tapping the creek so far from the plant, the company got an uncontaminated and unpolluted source, above the spot where other industries discharge into the creek.

The filtration plant will be fitted with sand filters, and the filtered water, which will have only one half as many grains of hardness as that now being used, will go to a 200,000 gallon tank. Automatic controls at the pump house will be activated by the tank's water level. The filtration plant, which is being built south of the Superior Division and just east of the new coating mill, will be 69 by 132 feet on the ground and 22 feet high.

At the site of the Bryant Paper Company's new water filtration plant at Kalamazoo (Mich.), William Cassell (left) and Robert La Fouche, of the Bryant company's engineering department talk over details. The plant will have a capacity of 8,000,000 gallons daily, will be equipped with sand filters, and will feed to a reservoir with a 200,000 gallon capacity. In the background is the site of the company's new coating mill, for which footings are now being placed

◆

CONSTRUCTION UNDER WAY ON NEW MILL AT PALATKA

The Hudson Pulp and Paper Corporation, of New York City, has started construction on a new $6,000,000 paper mill, to be located at Palatka, Florida, according to Abraham Mazer, president and founder of this concern.

Developed from holdings established by Mr. Mazer in 1896, the Hudson Pulp and Paper Corporation will own and operate a total of four mills when the Florida plant is complete. Other milling properties are located at Augusta, Maine, Bellows Falls, Vermont, and Lansdowne, Pennsylvania. These factories are known respectively as the Kennebec Pulp and Paper Division, the Moore and Thompson Division, and the Mazer Paper Division.

The firm manufactures kraft paper, gum tape, paper towels, paper napkins, and toilet tissue.

The Florida plant, fireproof in construction and covering approximately 150,000 square feet, will be equipped with a 234 inch papermaking machine, and the factory will have an intial capacity of 50,000 tons of kraft paper per year. When complete, it will employ 500 millhands and woodsmen. The plant was designed by J. E. Sirrine & Company, of Greenville, South Carolina, and Merritt, Chapman & Scott Corporation, contracting firm of New York City, has begun construction.

◆

MOVE TO PREVENT PAPER DUTY MISCLASSIFICATION

Customs officials have taken prompt action to prevent the misclassification of various papers which importers are endeavoring to bring into this country at lower rates of duty than those which the officials consider proper.

Imitation wood veneer paper from Canada has been classified for duty at 4½ cents per pound and 20 per cent, according to announcement by Warren B. Bullock, Manager of the Import Committee of the American Paper Industry. The paper was claimed to be dutiable as wall paper at 1½ cents per pound and 10 per cent, but the Import Committee provided evidence that it was generally known in this country as a decorated paper for box

covers, greeting cards and other such purposes.

Envelopes of bleached kraft claimed by the importer to be dutiable at the rate for printing paper have been classified for duty at the writing paper rate. The envelopes were shipped from Canada.

A high priced printing paper, valued at 15 cents per pound, has been classified for duty as printing paper. Domestic manufacturers conceded the paper was book not writing paper, and the duty rate imposed is equivalent to only 6⅔ per cent.

No effort has been made, according to Mr. Bullock, to evade the new classification for light weight newsprint and narrow width side runs of standard newsprint. Under a special Act of Congress newsprint not over 28½ pounds in weight and rolls not less than 15 inches in width were to be classified duty free as standard newsprint as long as Government controls limited the consumption of newsprint by publishers. With the end of newsprint control the old standard newsprint definition restricting free entry to 30-pound paper and 16 inch rolls has again become effective and shippers and consumers alike have accepted the return to the original definition of standard newsprint.

◆

NASHUA RIVER PAPER CO. ACQUIRED BY ST. REGIS

The purchase of the Nashua River Paper Company at East Pepperell (Mass.), by St. Regis Paper Company, New York, recently was announced. The mill, a large producer of kraft paper, was bought from William H. Anders, president of the Nashua company, and Louis Calder, who together owned all outstanding stock in the firm.

This purchase was negotiated primarily to increase the supply of multiwall grade specification kraft paper in order to better equip the St. Regis bag plants to meet increasing requirements.

Roy K. Ferguson, president of St. Regis, states that the Nashua River Paper Company will continue as a separate corporation, wholly owned by St. Regis, with William H. Anders as president, and the present management and organization retained.

◆

FINANCIAL

Even the threat of nation-wide strikes did not entirely halt the upward trend of securities in United States stock and bond markets, and paper securities followed the general trend. In some cases prices were higher than at any time since the 1930 depression. That the market tendency is in part due to hedging by investors against the threat of inflation, is shown by the fact that the principal advances have been in low priced common stocks, rather than in blue chip preferred issues.

A.P.W. Products Company—The company has registered with the Securities and Exchange Commission an issue of $2,000,000 of first mortgage and collateral trust 5 per cent sinking fund bonds and 80,000 shares of $5 common stock. The company is offering to present holders of its 6 per cent bonds the extension of the maturity rate from April 1, 1948, to April 1, 1966, reduction of the interest rate to 5 per cent, and reduction of the principal from $1,000 to $900. In consideration, the holders will receive without cost twenty shares of $5 common stock for each $1,000 principal of extended bond and rights to purchase additional common at from $6.25 to $7.50 per hare. Non-assenting bonds will be called for redemption.

Celotex Corporation—Bror Dahlberg has announced that Celotex Corporation is spending $7,000,000 to expand plant facilities, anticipating a national building program to relieve the housing shortage.

Champion Paper & Fibre Company—Net income for twenty-eight weeks ending Nov. 11, was $1,193,352 as against $1,072,937 for the comparable period in the preceding year.

Robert Gair Company—The Robert Gair Company has filed with the Securities and Exchange Commission, notice of an issue of 410,481 shares of $1 par common stock to be issued to holders of present stock in the ratio of one share for each three shares presently held, the price to be supplied by an amendment to the registry notice. Proceeds will be used to purchase of a stock interest of $5,500,000 in Gair Santee Corporation which proposes to erect a new $12,000,000 mill in the south for the manufacture of kraft container board. Gair-Santee Corporation will raise $4,000,000 through a loan to finance its interest and *Fort Wayne Corrugated Paper Company* will contribute the balance of $2,500,000. In a separate registration, the Fort Wayne Company announces an offering of 44,072 shares of cumulative $25 preferred stock and 44,072 shares of $10 common at a price to be announced later.

Gaylord Container Company—Net income for nine months ending September 30, 1945, was $742,473 as against $764,238 for the same period in 1944.

Marathon Corporation—Net profit for the fiscal year ending October 31, 1945, was $1,360,437 as against $1,603,016 for the preceding year.

Rayonier, Inc.—Net profit for six months ending October 31, 1945, was $758,785 as against $961,085 for the same period in 1944.

Strathmore Paper Company—Net profit for the year ending October 31, 1945, was $198,585 as against $221,803 for the previous fiscal year.

West Virginia Pulp & Paper Company—Net income for the year ending October 31, 1945, was $2,142,072 as against $2,383,587 for the preceding fiscal year, although sales increased approximately $100,000.

New York Stock Exchange—Stocks

	Closing Prices Jan. 25, 1946	Dec. 31, 1945
A.P.W. Products ..	10⅜	8⅞
Celotex	24½	23
Same Preferred..	21⅛	20¾
Certain-Teed Prod..	17¼	15
Same Preferred.	*114-115	*110-111½
Champion P&F Co.	48	50
Same Preferred	*112½-115	*110-112
Container Corp. ...	41	38½
Cont. Diamond ...	16	16
Crown Zellerbach..	29½	29¾
Same Preferred	*108¼-109	108
Same $4 Pref. ..	121¾	*116½-120
Dixie Vortex	49½	49½
Same "A"	55¼	54½
Robert Gair	10¾	9½
Same Preferred..	19½	19¼
Gaylord Container .	48¾	35¾
Same Preferred.	*95-100	79
International Paper.	45	48¼
Same Preferred..	120¾	122
Kimberly-Clark ...	65½	*65½-66¼
MacAndrews & Forbes	*40½-42	...
Masonite	60½	57
Mead Corp.	23	22
Same Pref...	*106-106½	*104½-105
National Container.	28⅜	28½
Paraffine Cos.	80	74-78
Same Preferred.	*108-111	*104-108¾
Rayonier, Inc.	26⅜	22½
Same Preferred..	37¾	37½-37¾
Scott Paper	53¼	*55-59
Same 4½% Pref.	*113-114	*111½-114⅜
Same $4 Pref.	*105¼-110	109
Sutherland Paper..	40	*40-40⅜
U. S. Gypsum.....	113½	114
Same Preferred..	*200-202	*196-203
West Va. P&P Co.	40	38½
Same Preferred..	114	113

New York Stock Exchange—Bonds

Abitibi $5	107	105¾
Celotex 3¾%	...	...
Certain-Teed 5½% ...		...
Champion P&F Co. 3%	103⅜	...
Int. Paper 5%....	103⅜	103¾
Same 6%	107½	107¼

New York Curb Exchange—Stocks

Am Writing	9⅞	10⅛
Great Northern ...	43½	42⅞
Hummel Ross	12¾	12¾
St. Regis	10¾	10¾
Taggart	9½	10
United Wall Paper.	11⅞	9⅞

*Closing Bid and Asked Prices.

PAPER · · · America's 6th Industry

FILTER PAPER FOR COFFEE MAKERS

(NEWS ITEM: *Sheets of filter paper, sold in packages of 100, are used with a new glass coffee maker.*)

Here's something new in coffee making — and paper makes it possible.

A sheet of filter paper is folded into a funnel, inserted in a glass coffee maker and filled with coffee. Water is brought to a boil in a separate kettle and poured over the coffee so that it filters into the lower compartment. The paper filter containing grounds is readily disposable. The manufacturer treats the filter paper to give it the desired wet strength.

This is only one of thousands of new uses for paper. Cosmetic containers made of paperboard . . . foodstuffs in paper cans . . . coal wrapped in paper packages . . . paper plates for frozen foods . . . each new use calling for new standards of lightness and toughness, new standards of quality in performance. New responsibilities — new opportunities for the Pulp and Paper Industry.

The Puseyjones Organization is now devoting itself completely to the design and construction of Paper-Making Machinery built to new high standards of speed and efficiency, and to the modernization of existing machines.

Among the machines now on order, the Puseyjones Organization is building two of the largest and highest speed Paper-Making Machines in the world — one for the manufacture of book and high-grade printing papers and the other for the manufacture of white paper for paper bags . . . Puseyjones is also building the latest type machine for the manufacture of high-grade cylinder paper and cardboard, equipped with improved Stream Flow Vat Systems.

Puseyjones Engineers will welcome the opportunity to work with you in solving production problems.

THE PUSEY AND JONES CORPORATION
Established 1848. Builders of Paper-Making Machinery
Wilmington 99, Delaware, U. S. A.

THE SIGN OF SUPERIOR QUALITY

Washington News

▶▶▶ An outstanding development of the month (January), was action taken by the Office of Price Administration authorizing material increases in the prices for groundwood papers. The increases were granted as a result of the showing by the industry that previous price ceiling so restricted the profits of manufacturers of low grade papers that they could not operate profitably, and concentrated their sales on higher priced papers giving them a fair return on manufacturing costs. This program forced consumers to buy higher quality papers than they desired, and the price increases granted were on the lower grades to equalize this anomalous situation. Increases were authorized on nineteen grades.

A new price regulation for book papers has been issued under which a somewhat lower ceiling is established for jumbo rolls as compared with previous prices computed on a sheet basis. To balance this changed base, the new ceilings authorize increases on converted paper in consonance with normal differentials for sheeting, colors, and other specified finishing and packing operations.

All newsprint controls have been canceled as of December 31, the only remaining factor being a continuance of inventory regulations. As a result of this order, newsprint paper in 15-inch rolls, and weighing from 28½ to 30 pounds again becomes dutiable printing paper. An Act of Congress provided that, for the time consumption of newsprint paper was under government control, newsprint paper should be considered duty free if not under 28½ pounds in weight or under 15 inches in roll width. With the end of Government control the old minimum limitation for duty free entry returns to 30 pounds and roll widths of 16 inches.

Still other changes have been made in Government controls. Order M-241 regulating the production of paper and paperboard has been revoked, and reserve production provisions to give Government agencies needed paper are no longer operative.

The joint United States-Canadian War Production Board has been liquidated by joint announcement by President Truman and Prime Minister Mackenzie King. Mathias W. Niewenhous has been named Director of the Forest Products Division of the Civilian Production Administration, succeeding George V. Johnson, resigned.

The Reciprocal Trade Agreement pot is beginning to boil. Congress last year passed an act to allow the administration to negotiate with other nations for the mutual reduction of tariffs. Hitherto, such negotiations have been carried on between the United States and individual nations. The new program proposes a joint conference of fifteen nations at least, at which tariff reduction agreements will be negotiated on a blanket basis instead of the previous bilateral negotiation method.

Under the law, advance notice must be given industry of items on which duties are to be included in such negotiations, but the consolidation of negotiations on practically the entire Tariff Act will mean extensive Government hearings. Some industry leaders fear that this program will mean radically limited opportunities for industries to present their cases. Inasmuch as previous reciprocal agreements have included many grades of paper, the paper industry is deeply concerned over any further duty reduction plans.

◆

KVP BUYS POWELL HOLDINGS IN APPLEFORD COMPANY

It is reported that Kalamazoo Vegetable Parchment Company, Parchment, Michigan, has purchased the financial holdings of the late W. B. Powell in the Appleford Paper Products Ltd., of Hamilton, Ontario.

It is stated that policies of Appleford will remain unchanged. Also that plans are under way to expand present facilities with new buildings and equipment as soon as possible.

The products converted by Appleford are similar to those manufactured by KVP. It is expected the line of converted paper products will be extended and enlarged and that Appleford will make available to the Canadian market all the specialty papers now manufactured by KVP.

The following officers have been elected: R. A. Hayward, chairman; George F. Clark, president and general manager; Ernest Smith, vice president and factory manager; Miss Marion Grayson, treasurer; C. S. Glassco, assistant treasurer; James Campbell, secretary.

◆

CONTINENTAL CAN CO. ACQUIRES PLANT OF FIBRE CAN MACH'Y CORPORATION

The Fiber Can Machinery Corporation of Rutland, Vermont, founded in 1937 to make high speed automatic machinery for the production of an improved style fiber container, has been acquired by Continental Can Company, Inc., New York.

Operations will be continued under the direction of J. F. Price, Continental's manager of operations, paper division, and R. S. Condon, vice president and chief engineer of the former company, will continue as chief engineer and plant manager.

Continental Can Company's paper division now comprises seven paper container, four fiber drum, and one corrugated box manufacturing plants; two paper mills, and the new Fibre Can Machinery Corporation.

◆

WISCONSIN'S WOOD USING INDUSTRIES CONFER ON CONSERVATION MEASURES

A state law to prevent tree owners from cutting undersized trees and sending them to market was strongly recommended at a meeting at Wausau, February 12, of leaders in Wisconsin's $300,000,000 wood using industries. The meeting was sponsored by the state conservation commission and was called, in the words of W. J. P. Aberg, of the commission, "to find out where we are heading in forestry and what we can do to head ourselves in the right direction."

Folke Becker, president of the Rhinelander Paper Company, keynoted the sentiment of the paper mill officials present, when he said:

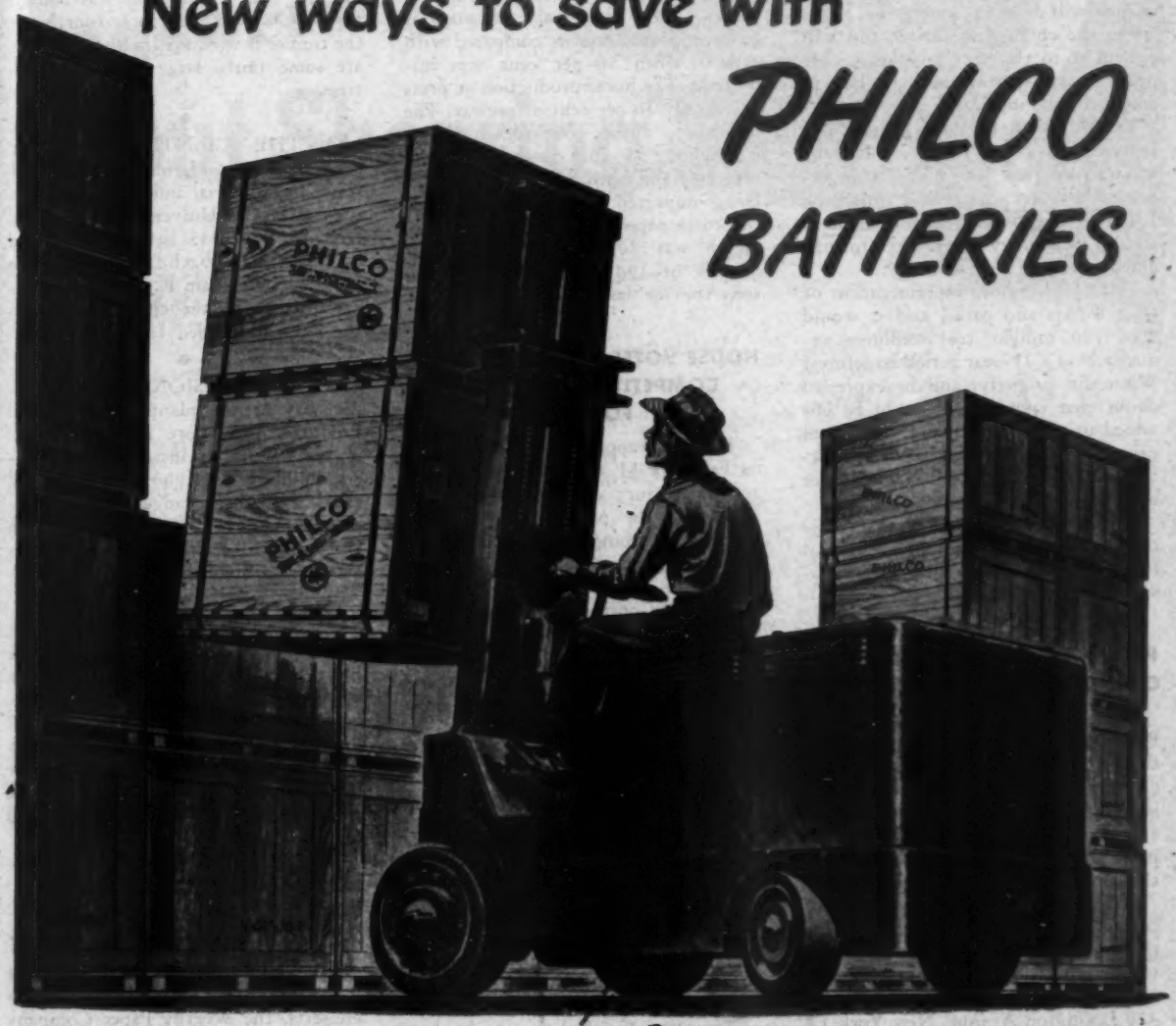
"We in Wisconsin must come to a place where we are agreed on how to handle our forests. The trend in the paper industry is for the mills to move to Canada. I think that soon—in a few years—the exportation of Canadian pulpwood will be largely prohibited. Perhaps Canada will permit exportation to Wisconsin mills which have already established mills in Canada. I'm sorry to have to say that. I believe that will happen."

Noting that at the last session of the legislature a bill regulating timber and pulpwood cutting was defeated, Charles F. Smith, conservation commissioner from Wausau, expressed the belief the measure failed passage because "one objection to it came from people who lacked confidence in the conservation commission and department to carry out the law."

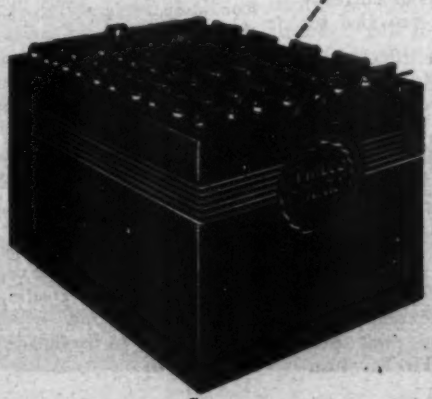
S. B. Bugge, of Tomahawk Kraft Paper Company, and George Kilp, of the Nekoosa-Edwards Paper Company, stated that Wisconsin would have a good chance of producing all the pulpwood it needs if all suitable land were planted and properly harvested under uniform state regulation.

M. N. Taylor, Merrill (Wis.), executive manager of Trees for Tomorrow, said that 40,000 employees are dependent on Wisconsin wood-using industries for a livelihood, including workers in 44 paper mills. He added his organization will plant a million trees in the Wisconsin River Valley this year as part of its program for reforestation.

New ways to save with PHILCO BATTERIES



Now you have palletized unit loads, and the new long-life Philco "Thirty" motive power batteries to make modern electric trucks even more useful and economical. The 30% longer life of Philco "Thirty" means substantial savings in battery replacements. Ask for Philco "Thirty" as initial equipment in your new trucks. Specify Philco "Thirty" on battery replacement orders. Write for specification data today. PHILCO CORPORATION, Storage Battery Division, Trenton 7, New Jersey.



PHILCO

FOR 50 YEARS A LEADER IN INDUSTRIAL STORAGE BATTERY DEVELOPMENT

Virgil Dickinson, Augusta (Wis.), commission chairman, said the commission will draw up another bill regulating the cutting of timber and will present it to the next legislature. He urged wood using industries to help in preparing the measure.

Donald S. Rochester, New York, representing the Forest Industries council, asserted the difficulty in reforestation lies in trying to reach farmers and absentee land owners, stating that they own three-fourths of the forests in the country.

C. L. Harrington, superintendent of state forests and parks, said it would take 100 million tree seedlings annually over a 25-year period to reforest Wisconsin properly, and he expressed doubt that enough seed could be obtained to meet the demand. He urged paper and lumber men to delay cutting as much as possible until tree seeds were ripe.

Several speakers asserted that Wisconsin has been slighted in federal forestry research appropriations in favor of southern states.

◆

PEJEPSCOT CO. ANNOUNCES CHANGE IN COMPANY CONTROL

Announcement comes from the Pejepscot Paper Company, New York, that control of the company has changed hands. However, no change in mill management is contemplated and all contracts and spot orders already accepted and acknowledged by the company will be fulfilled.

All details in connection with contracts and orders will be handled in the future by a separate independent sales organization known as the Arthur Schroeder Paper Company, located at 420 Lexington Avenue, New York 17, New York.

◆

▶▶▶ A PROPOSED TIMBER exchange is being negotiated by the Soundview Pulp Company, Everett, Washington, and the U. S. Forest Service. The terms of the contract provide that Soundview Pulp Company would exchange 1,000 acres of land near Baker Lake adjoining Mount Baker National Forest in exchange for high grade stands of fir and hemlock elsewhere in the forest. This exchange would preserve the Baker Lake scenic area in Whatcom County, north of Everett. About 20 million feet of timber are involved in the negotiations.

◆

▶▶▶ IT HAS BEEN disclosed recently that the French paper trade between March and August, 1945, has been producing approximately 20,000 tons of paper and board per month. Output is restricted on account of the small amount of coal allocated to the trade, also timber supplies are short. Very little pulp or wood is being imported now as compared with prewar when 50 per cent was imported. The home production at present is only 30 per cent of prewar. The immediate future outlook, however, is brighter, for coal quotas have been increased and both pulp and paper are being imported. It is expected that the total paper and cardboard ration, which was 70,000 during the first quarter of 1945, will reach 116,000 tons for the last quarter.

◆

HOUSE VOTES TO RETAIN COMPETITION IN PAPER FOR U. S. CURRENCY

The house appropriations committee on February 11 voted to retain in the annual treasury department appropriation bill, the provision designed to secure more competition in manufacture of paper for U. S. Currency and securities.

Crane & Company, Dalton (Mass.), has had the entire contract for eight years. Previously the Collins Manufacturing Company of Holyoke and North Wilbraham (Mass.), bid on a small portion of the contract. Generally speaking, Crane has had this contract for nearly sixty years.

Under the competition provision in the bill, the secretary of the treasury is authorized to split the award for currency paper between the two lowest bidders, otherwise the whole contract would have to be awarded to the lowest. In retaining this clause, the appropriations committee overrode suggestions of both the bureau of the budget and the treasury department.

Treasury officials hope to purchase the paper for the coming fiscal year, starting July 1, for the 39-cent price per pound now prevailing, it was indicated in hearings before a subcommittee of the house appropriations committee. The paper is of 50 per cent cotton, and 50 per cent linen. The appropriation bill provides $775,000 for 72,500,000 sheets of currency paper, the same amount provided for the present fiscal year.

◆

▶▶▶ A THIRD NEWSPRINT machine has been placed in operation by the Washington Pulp and Paper Corporation at its plant in Port Angeles, Washington, but a limited supply of logs has prevented capacity production on the machine.

◆

▶▶▶ A TIMBERLAND tract in Columbia County, Oregon, was purchased recently by the Fir-Tex Insulating Board Company, St. Helens, Oregon. The 2,838 acres was bought for $10,780. About three-fourths of the timber is still small, although there are some fairly large second growth trees.

◆

▶▶▶ THE SCIENTIFIC LIBRARY of the late Dr. Harold Hibbert, professor of industrial and cellulose chemistry at McGill University in Montreal from 1925 to 1943, has been purchased by Crown-Zellerbach Corporation, San Francisco. William R. Barber, technical director of the company, reports the library included 1,500 volumes.

◆

▶▶▶ CONVERSION TO OIL is under way at the plant of Fibreboard Products, Inc., Port Angeles, Washington. Work of installing oil burners, building a 35,000 gallon fuel oil tank, and other changes will be completed this spring. This is in line with the trend of Pacific Coast industries away from hogged fuel.

◆

▶▶▶ WATER-BORNE PULP shipments were resumed recently by the Longview, Washington, pulp division of the Weyerhaeuser Timber Company, with the freighter "Andarko Victory" loading 1,200 tons for the East Coast. The shipment was the first by water in more than four years, with wartime shipping shortages necessitating rail movements.

◆

NATIONAL PRINTING CO. ACQUIRES CONTROL OF WORTHY PAPER COMPANY

Controlling interest in one of the oldest industries in western Massachusetts, the Worthy Paper Company of North Agawam, has been purchased by the National Printing Company of Thompsonville, Connecticut.

George R. Ronaldson of Longmeadow, Massachusetts, is president of National; J. R. Gerich of Somers, Connecticut, is treasurer; and Mrs. Rita C. Ronaldson is secretary.

The president's son, Douglas W. Ronaldson, recently discharged from the Navy, will be manager of the Worthy mill. This position was held for many years by Gorham Bliss, in whose family the Worthy mill has been for generations.

Mr. Ronaldson, president, states that the purchase was prompted by the high regard his company has for the fine papers made by the Worthy mill, particularly the special papers which National uses in its art department in New York where greeting cards are manufactured, and which are the nearest thing to handmade papers that he knows of.

Need Answers about Shearing [illegible]?

Shear Blades?
What tolerances are recommended on blades for shearing E-S Type 304 Stainless? Can we use the same blades on E-S Type 316?

Fine Perforating?
What is the smallest diameter hole that can be accurately punched in 30-gage E-S Type 302 sheet, and what is the minimum spacing that will not tear between perforations?

Clearance for Blanking?
What die clearance should we use for blanking 6-in. circles in No. 7-gage E-S Type 410 plate?

Clean Slitting?
In slitting and drawing small louvres in E-S Type 321 Stainless, the metal sometimes strings across the slit. How can we overcome this?

Die Changes?
Will E-S Type 430 break out when stamped? Can we use the same dies in stamping E-S Type 430 that we use in stamping E-S Type 347?

Anneal to Trim?
After spinning E-S Type 304 bowls, we want the edge soft enough for trimming and corrugating, without a second anneal. Is this possible?

ask Eastern for the answer when Stainless is the question

Questions like these are "duck soup" at Eastern. Many of the answers are given in the big new catalog, "Eastern Stainless Steel Sheets," but if you have a specific question about cutting or shearing Stainless, be sure to ask Eastern...where your inquiry is welcome.

EASTERN STAINLESS STEEL CORPORATION
BALTIMORE 3, MARYLAND
CHICAGO · CLEVELAND · DALLAS · DETROIT · LOS ANGELES · NEWARK · PHILADELPHIA

ES

Cushion

THE INFLATIONARY SQUEEZE

When consumer demands and purchasing power increase faster than the available supply of commodities there is an immediate turn at the vicious screw of inflation. In the paper and board industry Hamilton Felts are the most effective brakes to a run-away market. Government controls are, at best, artificial checks. Hamilton Felts are *naturals*. By removing more water at the couch Hamilton Felts permit paper and board machines to be operated at higher speeds with less down time for adjustment, less broke and less steam at the driers . . . This all adds up to increased tonnage to cushion the inflationary squeeze.

From the thinnest tissue to the heaviest board there is a Hamilton Felt that will do your work better, faster and at lower cost.

SHULER & BENNINGHOFEN, HAMILTON, OHIO

Miami Woolen Mills

Hamilton Felts

Established 1858

PAPER BOARD SIZING

IS NO PROBLEM!

TRY Kelgin

You'll be surprised at the splendid results and remarkable economy of sizing paper board with KELGIN — for wax coatings and gloss ink printing.

KELGIN dissolves quickly in cold or hot water and is adaptable to water box application on the calender stacks. It has other money-saving applications, too. It may be just the sizing material you've been looking for.

Worth trying — for it's very inexpensive. Our Technical Department will give you full cooperation in your application of KELGIN.

KELCO COMPANY

75 E. Wacker Drive
CHICAGO-1

31 Nassau Street
NEW YORK-5

530 W. Sixth Street
LOS ANGELES-14

Bronze Valves with a Pedigree

The Powell Line of Bronze Valves for controlling intermediate steam, oil, water and gas is not an overnight development. Rather, it is a result of evolution through Powell's 100 years of practical, scientific progress in the art of valve-making.

Starting in the first generation with the celebrated "Star" Regrinding Globe Valve, invented and patented by James Powell, each succeeding generation of the Line has produced better and better valves. Today the nation-wide performance of Powell Bronze Valves definitely stamps them as "Valves with a Pedigree."

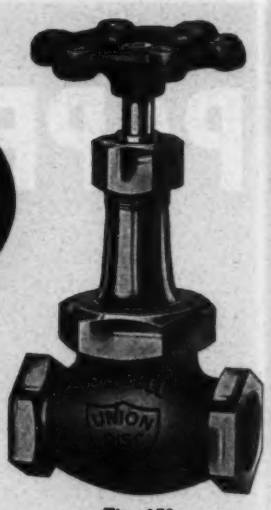


Fig. 150

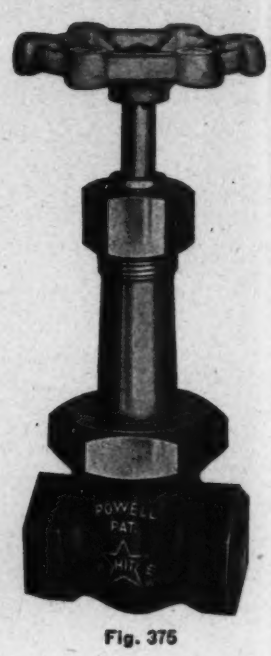


Fig. 375

Fig. 1708

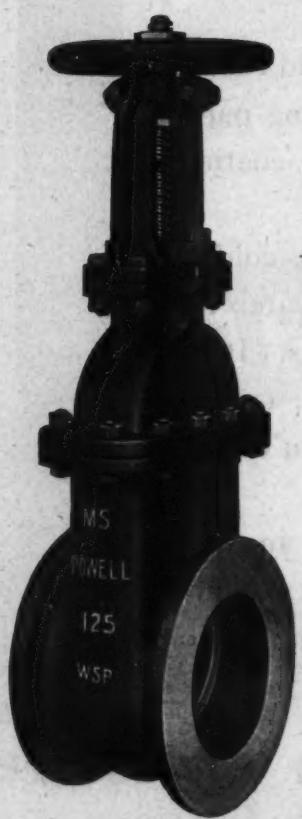


Fig. 1414

Fig. 500

Fig. 1414—125-pound Bronze O. S. & Y. Gate Valve with flanged ends.

Fig. 500—125-pound Bronze Gate Valve with screwed ends, inside screw rising stem and screwed bonnet.

Fig. 1708—200-pound Bronze Globe Valve with screwed ends, inside screw rising stem, union bonnet, renewable seat and regrindable, renewable wear resisting semi-cone plug type disc.

Fig. 375—200-pound Bronze Gate Valve with screwed ends, inside screw rising stem, union bonnet and renewable wear resisting seat rings and disc.

Fig. 150—150-pound Bronze Globe Valve with screwed ends, union bonnet and renewable composition disc.

The Wm. Powell Co., Cincinnati 22, Ohio

DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

POWELL VALVES

Above map does not attempt to show all products available in the various states

For more than 75 years, Union Pacific has served thirteen western states . . . been a partner in their development.

This vast fertile territory is more than the breadbasket of the nation. Due to its great wealth of industrial raw materials—ore, minerals, petroleum and lumber—it might also be called the nation's treasure-chest. Rivers have been harnessed—providing irrigation and power. And there is splendid rail transportation.

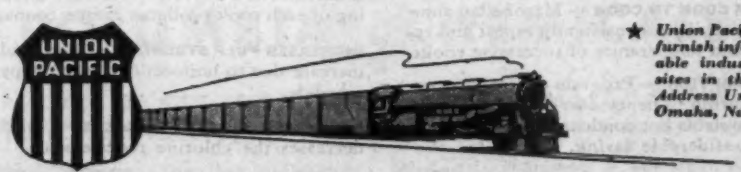
In the Pacific Northwest, for example—a large source of supply for the paper industry—Union Pacific has the equipment and personnel to meet all the requirements of shippers.

These thirteen western states served by the railroad are ripe for postwar expansion. They have the materials, facilities and space.

Union Pacific will continue to play its part in the future progress of this western territory by providing unexcelled freight and passenger transportation over its Strategic Middle Route.

Be Specific— say "Union Pacific"

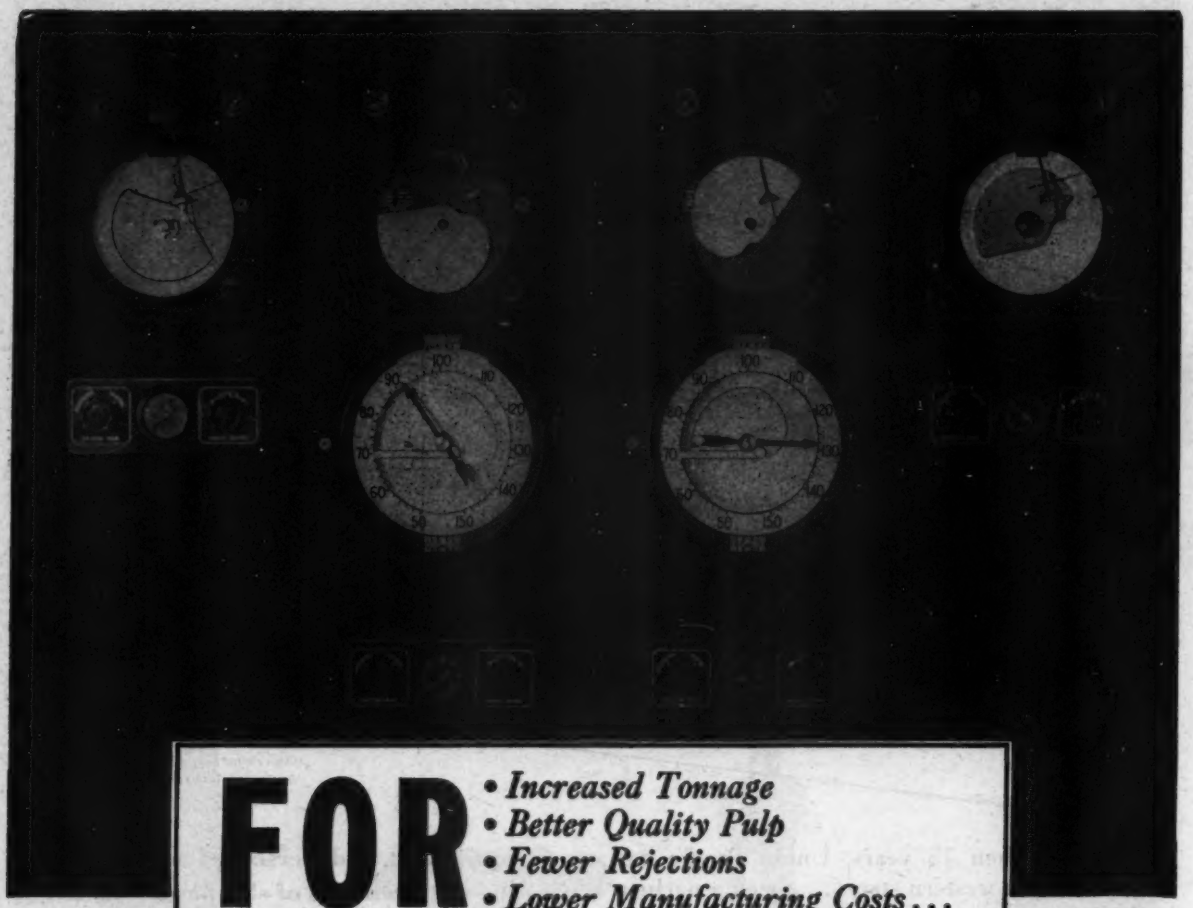
★ *Union Pacific will, upon request, furnish information about available industrial and mercantile sites in the territory it serves. Address Union Pacific Railroad, Omaha, Nebraska.*



The Progressive

UNION PACIFIC RAILROAD

The Strategic Middle Route



FOR

- *Increased Tonnage*
- *Better Quality Pulp*
- *Fewer Rejections*
- *Lower Manufacturing Costs...*

USE MASONEILAN DIGESTER CONTROLS

Remove as many variables as possible at the Digester and keep those remaining under strict control . . . then you're sure to get uniform pulp at decreased cost.

Masoneilan Digester Controls do just that by taking the guesswork from the cooking process. Once a cycle is determined, these controls will repeat any selected program year after year. Here are the advantages Masoneilan Digester Controls give you —

A UNIFORM PULP — by holding a constant time and pressure schedule and by varying the maximum cooking temperature to compensate for variations in the amount of free SO_2 in the cooking acid.

FEWER REJECTIONS — by controlling the selected and maximum temperature schedule.

UNIFORMITY FROM COOK TO COOK — Masoneilan automatic time cycle controllers consistently repeat and record the pressure and temperature of successive cooks.

LOW STEAM CONSUMPTION — Program controllers prevent over-temperaturing — hence over-cooking. On indirect circulating systems hot condensate is returned to boiler house at considerable saving.

UNIFORM STEAM CONSUMPTION — cycle controllers allow for proper spacing of boiler load.

GAS RECOVERY — time cycle control of relief gas properly proportions it to the recovery process to keep uniform strength in the reclaimed acid.

GREATER PRODUCTION — accurate timing and scheduling of each cook produces greater tonnage.

INCREASED PULP STRENGTH — pop and fold strength increase due to uniformity of the temperature cooking schedule.

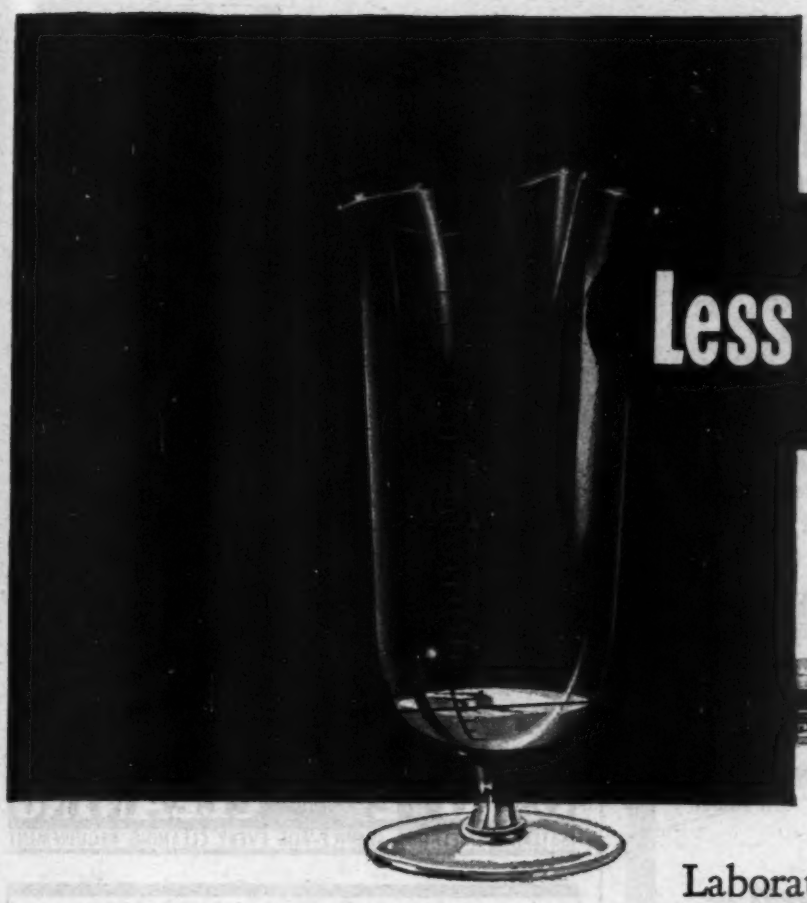
DECREASED BLEACHING COSTS — uniformity of pulp decreases the chlorine requirement.

Add your name to our list to receive new bulletin now in preparation

MASON-NEILAN
1196 ADAMS STREET

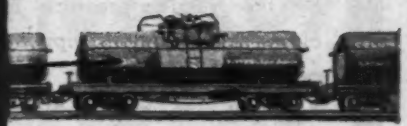
MASONEILAN

REGULATOR CO.
BOSTON 24, MASS., U.S.A.



Less than 1 oz.

in 40 tons



Laboratory perfection

in large-scale production of **CAUSTIC SODA**

The manufacture of numerous products requires Caustic Soda of utmost "purity"—that is with its metallic content, such as copper or iron, rigidly controlled. In the production of high-strength textiles, for example, the presence of as much as one ounce of these impurities in 40 tons of caustic may result in an inferior product!

Caustic Soda readily picks up such metals, however. To prevent contamination is relatively simple in the laboratory—but production on the vast scale required to meet huge industrial needs necessitates ingenious methods and infinite care in processing and handling.

The achievements in meeting exacting industrial standards—including the patented purification process for producing high grade diaphragm electrolytic Caustic Soda—are characteristic of Columbia operations. They are important reasons for entrusting your requirements for alkalies and related products to Columbia.

COLUMBIA CHEMICALS

PITTSBURGH PLATE GLASS COMPANY • COLUMBIA CHEMICAL DIVISION

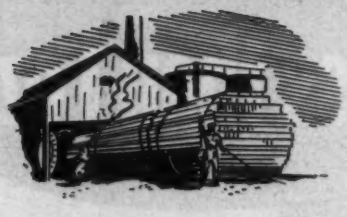
FIFTH AVENUE at BELLEFIELD • PITTSBURGH 13, PENNSYLVANIA

Chicago • Boston • St. Louis • Pittsburgh • New York • Cincinnati • Cleveland • Philadelphia • Minneapolis • Charlotte • San Francisco

COLUMBIA ESSENTIAL INDUSTRIAL CHEMICALS

Soda Ash • Caustic Soda • Sodium Bicarbonate • Liquid Chlorine • Silene EF (Hydrated Calcium Silicate) • Calcium Chloride • Soda Briquettes
Modified Sodas • Caustic Ash • Phosflake • Calcene T (Precipitated Calcium Carbonate) • Pitchlor (Calcium Hypochlorite)

PRESSURE IS PROTECTIVE **TREATMENT**



For most effective wood preservation, the chemicals must be forced *deep* into the wood. American Lumber & Treating Company obtain this deep penetration by the vacuum-pressure method in closed steel cylinders. Dipping, brushing on, or other makeshift methods can't begin to give comparable results. So, when you buy treated lumber, remember to say "pressure-treated"...it's best!

Whatever your needs —

AMERICAN LUMBER GIVES YOU ALL 3

1. Wolmanized Lumber* — protects against decay and termite attack.
2. Minalith — fire-retardant.
3. Creosoted lumber.

1658 McCORMICK BUILDING, CHICAGO 4, ILLINOIS

KEEP MILL MAINTENANCE COSTS DOWN WITH EASY OAKITE CLEANING

Scientific 3-Way Action Cleans Beaters Faster!

By using the Oakite Solution-Lifting Steam Gun for cleaning beaters, dandy rolls, screen plates, save-alls, Fourdrinier wires, you bring to each job speed, ease, reduced maintenance cleaning costs.

The triple combination of heat, mechanical force and stepped-up detergent action which this modern Oakite steam-detergent method provides, assures COMPLETE removal of ALL slime and similar deposits. Let us tell you MORE about the Oakite Solution-Lifting Steam Gun. Let us show you how it can help in MANY ways to speed cleaning in YOUR mill. There is no obligation. Write TODAY!

OAKITE PRODUCTS, INC., 16 Thames St., NEW YORK 6, N. Y.
Technical Service Representatives Conveniently Located in All Principal Cities of the United States and Canada

OAKITE *Specialized* **CLEANING**
MATERIALS · METHODS · SERVICE · FOR EVERY CLEANING REQUIREMENT

WATERBURY FELTS

are made by

H. Waterbury & Sons Co.

Oriskany, New York

HARDY S. FERGUSON & COMPANY

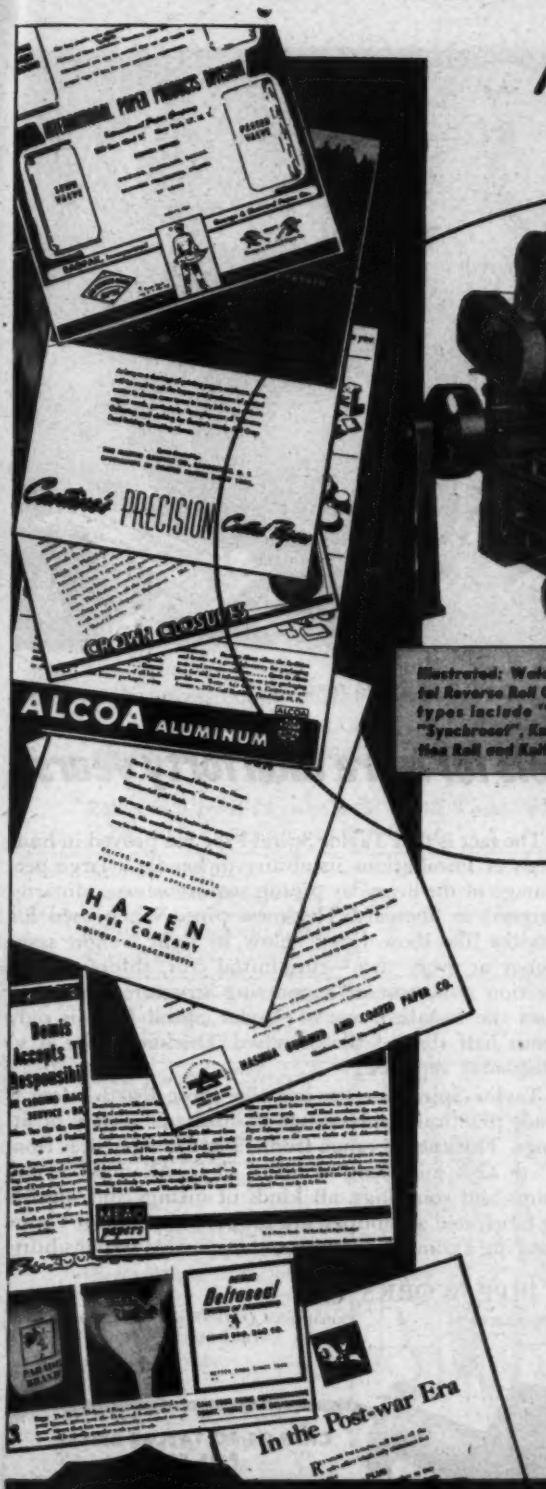
CONSULTING ENGINEERS

200 FIFTH AVENUE **NEW YORK 10, N. Y.**

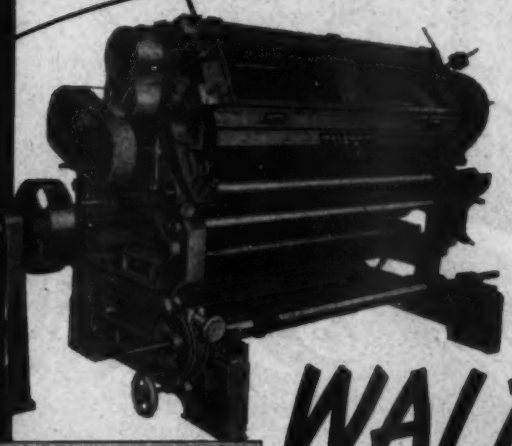
Hardy S. Ferguson—Member *A.S.C.E. A.S.M.E. E.I.C.*
Moses H. Tease—Member *A.S.C.E. A.S.M.E. E.I.C.*

Consultation, reports, valuations, and complete designs and engineering supervision for the construction and equipment of

- PULP AND PAPER MILLS AND OTHER INDUSTRIAL PLANTS
- STEAM AND HYDRO-ELECTRIC POWER PLANTS
- DAMS AND OTHER HYDRAULIC STRUCTURES



PART OF THE PICTURE of famous products



Illustrated: Waldron Horizontal Reverse Roll Coater. Other types include "Micro-Jet", "Synchrocoat", Knife, Combination Roll and Knife.

WALDRON COATERS

The first coating machine in this country was built by WALDRON in 1852. In every major development in the science of coating since that time, WALDRON engineers have played a prominent part. Today, modern WALDRON machines are designed for a wide variety of coating methods devised to meet individual product and processing problems.

To insure maximum speed, uniformity and quality of coating, the leading makers of coated paper and fabrics specify machines designed and built by WALDRON—machines that embody nearly a century of engineering experience in producing precision coating. Whatever your coating problem, there's a modern WALDRON machine especially designed to correctly meet it.

Utilize the services of our Research and Development Staff and the facilities of our Testing Laboratory to determine in advance your equipment requirements.

JOHN WALDRON CORP.

Main Office & Works — NEW BRUNSWICK, NEW JERSEY

CHICAGO - 6 — 201 N. WELLS ST.

NEW YORK - 17 — 150 MADISON AVE.

BOSTON - 9 — 79 MILK ST.

BUILDERS OF QUALITY MACHINES SINCE 1827

"Tell me Bill . . . How did the Taylor Spiral Pipe come through?"

It's been coming through with laurels for more than forty years!

Those who know Taylor Spiral Pipe well, never cease to marvel at the rugged strength it possesses despite its light wall thickness. And there is good reason to marvel; for by any test it is the strongest type of pipe made.

A 12-inch, 12-gauge length of Taylor Spiral was not crushed or perceptibly distorted by a 9-ton load. A 20-foot length of 12-inch, 10-gauge pipe, supported only at its center, did not buckle under a load of nearly five tons supported from its extreme ends. A 12-inch, 12-gauge pipe has a bursting strength up around 900 lbs. per sq. in. So on all counts Taylor Spiral has greater strength than any other type of pipe of equal wall thickness.

But too many pipe users fail to recognize this, or at least fail to do anything about it. For every service that doesn't call for heavier pipe they continue to use Standard Thickness as though it represented the low point on the scale of available pipe thicknesses—as though light-but-strong Taylor Spiral were not available.

The fact is that Taylor Spiral Pipe has proved in hundreds of installations its ability to handle a large percentage of the everyday piping requirements ordinarily assigned to Standard Thickness pipe. When used for services like those listed below its light weight saves money at every turn—cuts initial cost, shipping cost, erection cost, cost of supporting structures. In many cases the installed cost of Taylor Spiral Pipe is only about half that of the Standard Thickness pipe it so adequately replaces.

Taylor Spiral for services like those listed below is made practical by the range of sizes and variety of fittings. Thicknesses range from 12 to 6 gauge; sizes from 6" to 42"; joint lengths up to 40 ft. All types of end joints and couplings, all kinds of fittings and specials or fabricated assemblies, are produced by Taylor Forge, assuring a complete service and undivided responsibilty.

TAYLOR FORGE & PIPE WORKS

General Offices & Works: Chicago, P. O. Box 485 ★ New York Office: 50 Church St. ★ Philadelphia Office: Broad Street Station Bldg.

TAYLOR
SPIRAL PIPE
CHANGE TO TAYLOR SPIRAL PIPE FOR:
• High and Low Pressure Water Lines
• Low Pressure Steam and Air Lines
• Steam and Diesel Exhaust Lines
• Vacuum and Suction Lines
• Blower Piping
• White Water Lines
• Pulp Stock Lines
• Paper Stock Lines
• Alkaline Lines
• Size Lines
• Swing Pipe
• Spray Pond Piping

BAUER PULPER INSTALLATIONS

Produce long, pliable, free fiber. From many different raw material sources for almost every grade of finished output. The tabulation of actual mill applications below will interest you—give you a clear picture of the range of stocks being successfully pulped with Bauer equipment.

Raw Chips from Logs or from Wood Waste, Slabs, Edgings, Tree Tops, Veneer Waste.

Steamed Chips.
Semi-Chemically Cooked Chips.

Extracted Chestnut Chips.
Extracted Pine Stump Chips.

Groundwood Bull Screen Rejects
Groundwood Knotter Screen Rejects
Groundwood Fine Screen Rejects

Kraft Knotter Rejects
Kraft Screen Rejects

Sulphite Screen Rejects

Waste Printed Papers; Ledgers
Waste Wet Strength Papers
Waste Corrugated Papers
Waste Papers in General

Bagasse Fiber
Licorice Root Fiber
Bamboo Fiber

Stock enters at F, passes between plates PP, positioned between disks A and B . . . and is discharged at E.

THE **BAUER BROS.** CO.
SPRINGFIELD, OHIO

Bauer Pulpers are in service in: The United States, Canada, Mexico, Hawaii, New Zealand, Australia, India, Sweden and Russia.

Bauer
THE BAUER BROS. CO.
SPRINGFIELD OHIO

as the sea itself!

Scientists have made many guesses as to how long the seas of the world will last. Some think they will last forever. There is little guessing, however, as to how long Harper non-ferrous and stainless fastenings will last . . . they will far outlast the assemblies in which they are used. Even in corrosive chemicals they will outlast common steel because . . . Harper Everlasting Fastenings are made exclusively of Brass, Copper, Naval Bronze, Silicon Bronze, Monel Metal or Stainless Steel and will not rust or corrode.

everlasting fastenings

A stock of over 5000 different types and sizes of bolts, screws, nuts, washers and other standard items assures fast delivery of your orders. Specials are engineered and produced from raw materials on hand for speedy fabrication. Ask for our 120-page 4-color catalog for easy reference.

THE H. M. HARPER COMPANY
2647 FLETCHER STREET • CHICAGO 18, ILLINOIS

Branch Offices:
NEW YORK CITY
PHILADELPHIA
LOS ANGELES
MILWAUKEE
CINCINNATI
HOUSTON
Representatives in principal cities

HARPER
Chicago

FOR "Slicker" COATED STOCK...

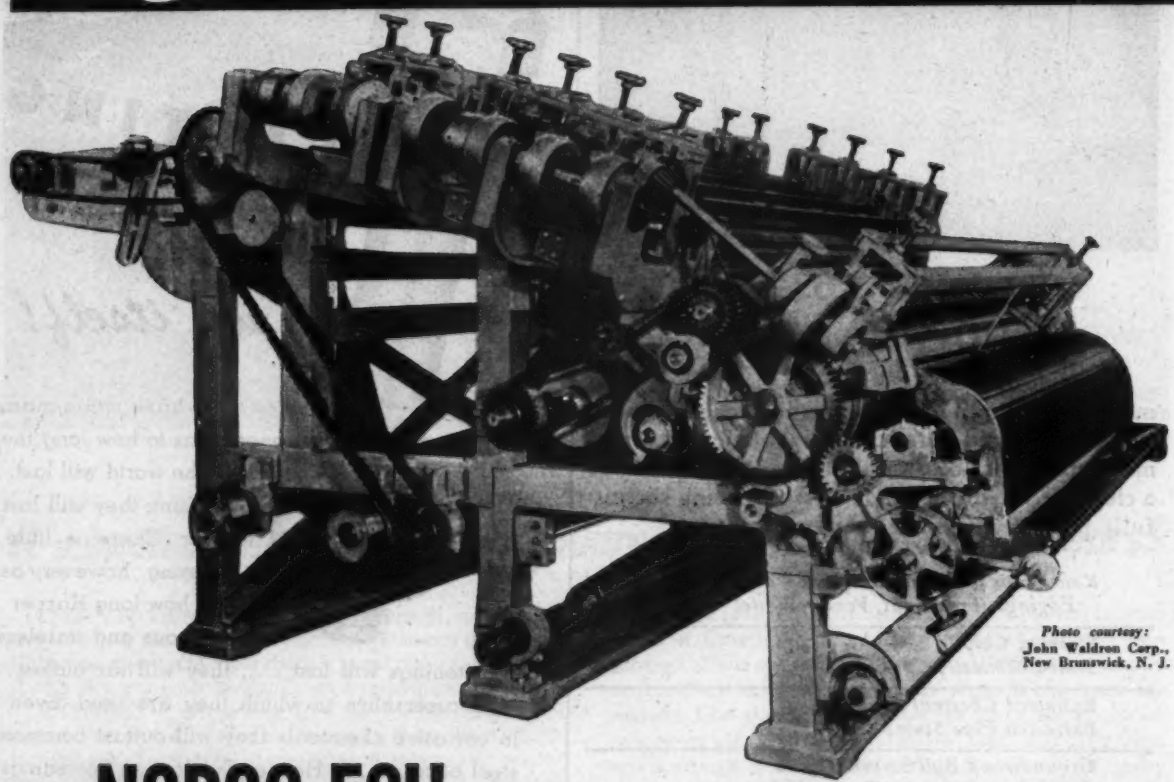


Photo courtesy:
John Waldron Corp.,
New Brunswick, N. J.

USE NOPCO ESI!...New Aqueous Dispersion of an Insoluble Metallic Soap Improves Flow and Brushing Characteristics.

Nopco KF, Nopco Eveners, Defoamers, Wax Sizes, and other Nopco products are already well known aids to stepped-up paper volume and quality. To this effective group, NOPCO ESI is now added to help improve the finish of coated papers —for application in either the conventional coating operation or in the actual paper machine coating process.

NOPCO ESI is readily dispersed in water to any desired concentration. The dispersion thus formed is quite stable to mild acids or alkalis. It thoroughly plasticizes the pigment particles even after the coating has dried. Thus a troublesome dusting problem is eliminated. Other advantages include noticeably higher gloss and brightness.

Because mills often find it difficult to obtain uniformly satisfactory performance from coatings—and because recent users of NOPCO ESI feel that it imparts a "slicker" feel to their coated stocks—NOPCO ESI offers interesting possibilities to mills seeking a more satisfactory solution of their coating problems. Further particulars on request.

NOPCO ESI
Aqueous Dispersion of an Insoluble Metallic Soap

NATIONAL OIL PRODUCTS COMPANY, Harrison, N. J.
Branches:
Boston • Chicago • Cedartown, Ga. • Richmond, Calif.

An affiliate of the American Pulp and Paper Mill Superintendents Association

NOPCO EVOLVED THROUGH RESEARCH
REG. U. S. PAT. OFF.

Quick Facts... for Plant Engineers about a.c.f. lubricated plug valves

Longer efficient valve life is obtained in the a.c.f. Lubricated Plug Valve by the following design features:

- *Full port opening equal in area to the pipe it serves—valve causes no increase in velocity.*
- *Full area means unrestricted free flow—maximum speed with minimum power and expense.*
- *Straight through flow—no change in direction to cause abrasion and pressure loss.*
- *No pockets or traps in which ladings might lodge.*
- *Tight against head leaks under any line pressure.*
- *Quick operation—full open to full closed in ¼ turn.*
- *No vital seating surface exposed to lading—minimum abrasion.*
- *Protected against corrosion—working surfaces constantly supplied with fresh lubricant.*
- *Easily dismantled for repairs—compact simple construction, no auxiliary packing.*
- *a.c.f. Lubricated Plug Valves will efficiently handle all processing and industrial plant ladings.*

Full Unrestricted Pipe Area reduces pumping costs and speeds up processing and/or production. Try a.c.f. Lubricated Plug Valves in your own operation and learn the difference. Representatives in principal cities carry adequate stocks. For description of various types with complete specifications write for catalogue No. 3 PI.

a.c.f.

AMERICAN CAR AND FOUNDRY COMPANY

VALVE DEPARTMENT

30 CHURCH ST., NEW YORK, N. Y.

Merfenelopes

FOR SLIME CONTROL

In a one-ounce sealed envelope. Throw it in the beater unopened

Cleans Pipes
Kills Bacteria
Reduces Washups
Fewer Slime Rejects

R. T. VANDERBILT CO., INC.
230 Park Avenue, New York City

Editorial

The Demand Is Upon Us

▶▶▶ A HUGE, GROWING, overwhelming demand for paper products is upon the paper industry.

The demand for tonnage from the consumers of all kinds of paper is greater today than at the peak of the war demand.

The supply is wholly inadequate and from the present outlook production for 1946 will be less than that for 1945. In that event, the industry will hang up a record of five years operations at below the production figures of 1941-viz. 17,762,365 tons—which constituted the all-time high production record in the history of the industry.

There can be no question in the minds of the operators, but that the expanded demand which has been piling up during the past five years, warrants the building of new mills. More pulp is the key to this drastic shortage situation. With the demand for paper rising continuously and the supply remaining static or declining each year from its 1941 high, the gap between demand and supply grows correspondingly wider all the time. It precludes any early approach to a balance.

In that, to our notion, lies a serious menace to the future return to freedom of enterprise for this industry. An announcement from the OPA intimates that those industries which show an unbalanced demand and supply situation will be retained under OPA price and profit regulations.

How, then, can the paper industry balance its demand and supply condition? If it cannot, where, then, can the consumers of paper products, including the government agencies, look for their supplies of these essential commodities? Will the Government move in and take the entire control or build new mills for the insurance of its own and allied agencies' supplies?

It is being done in food and flour. Other commodities will be similarly affected. The OPA and the administration refuse to provide the industry with the price incentives to insure increased and abundant production.

The situation is critical. Consumers, faced with the closing down of their businesses, are going to become difficult. They don't care from what source the relief supplies come. They demand paper.

When Delilah said to Samson: "The Philistines be upon thee!," the strong man burst his bonds and went to work on them, cleaned them up and regained his freedom. But, when through deceit, they sheared his locks, they led him away captive and the end was they brought down destruction upon all of them.

We would paraphrase Delilah's words and cry out: "A big unsatisfied demand is upon thee, Paper Industry!" But, it looks like we are powerless to burst our bonds. We passed the secret of our strength to our shearers. It seems that we are to be lead away captive by the enemy of free enterprise, the benighted bureaucracy.

The demand is upon us! What are we going to do about the supply?

"All Doors Open To Courtesy"

▶▶▶ A TRAVELING SALESMAN, representing an old and outstanding firm in a highly important line of business, recently told a small group of friends and acquaintances that he had made no contacts with his trade for the past year and a half. He had nothing to sell, so his firm took him off the road. After that, by chance, he met one of his old customers. The customer told him that his wants were being met by several small firms, in fact not one of these firms was known to the salesman, and that no word of any kind had been received from his old source of supply since the salesman stopped calling—not a letter, not a piece of printed matter, not a contact of any kind.

No doubt this same sort of customer treatment was more common throughout the war years than even the firms involved would be willing to admit. There may be cases where this policy could not be avoided but in the great majority of cases, it is believed that such neglect was shortsighted and unnecessary. Some of the firms guilty of such practice—however just or unjust it may seem—may never be able to re-establish themselves with certain of their former customers.

How different have been the efforts of far-seeing firms confronted with the same, or at least a somewhat similar, marketing situation. These far-seeing firms have kept contact with their old customers, have made contacts with prospects, and have laid the groundwork for postwar business. They have done all of these things with little or nothing to sell other than to war industries.

Evidence of the far-reaching job done by one of these progressive firms has been crystallized in a very dramatic brochure entitled *Your Unseen Friend.* This brochure brings into immediate focus the advertising themes of International Nickel Company for 1943, 1944, and 1945. In 1943, the theme was "A Just and Durable Peace"; in 1944, "Postwar Job Opportunities," and 1945, "Nickel's Role in Postwar Production."

More than 25,000,000 readers were reached by this advertising. Nearly a hundred leading business magazines and several national magazines, as well as highly developed educational and service programs, were used to reach every possible market—industrial and consumer. This thorough cultivation of both old and new markets, at a time when it would have been easier to discontinue all kinds of business promotion, is indicative of the progressive policy of International Nickel. It surely is a policy that has permitted quick conversion from war to peace.

Other firms, too, each in its own individual fashion, have worked to the same end. To every one of them is due the thanks of all America.

Current Thought

Let's Applaud—Not Criticize

WILLIAM SIBLEY

For I dipt into the future, far as
human eye could see,
Saw a Vision of the world, and all
the wonder that would be;

Saw the Heavens fill with commerce,
argosies of magic sails,
Pilots of the purple twilight,
dropping down with costly bales;

Heard the Heavens fill with shouting,
and there rain'd a ghastly dew
From the nations' airy navies
grappling in the central blue;

Far along the world-wide whisper
of the south-wind rushing warm,
With the standards of the peoples
plunging thru' the thunder-storm;

Till the war-drum throbbed no longer,
and the battle-flags were furl'd
In the Parliament of man,
the Federation of the world.

There the common sense of most shall
hold a fretful realm in awe,
And the kindly earth shall slumber
wrapt in universal law.

Alfred Tennyson wrote those immortal lines a century or so ago, and either callous, dead, or savage is the heart not stirred by them. It is a word-picture of the millennium; the ideal which appeals to all men of good will. To the realist, it represents the unattainable; to the idealist, something that is "just around the corner." Neither is right.

The question is: Will we attempt to make a start at embracing the millennium now? We made a miserable failure of The Hague; abandoned an improvement in the League of Nations; foresook the compromise World Court—and found ourselves in another war of almost immeasurable proportions. Now we have closed that war, and are preparing to face the reality of liquidating the indebtedness it caused. At the same time we have set up the United Nations Organization, now engaged in solving its first problems in London. Will we bicker and quarrel and fume about UNO's procedure, or will we get behind and push?

The UNO is by no means the ideal organization, nor yet is it the most efficient. It is filled with representatives of some fifty nations—all of whom were assigned their position to take care of their country's particular interests, and many of whom are little more than self-seeking politicians. It is far from being an "ideal" setup; distant from being the organization that can accomplish all we hope for. BUT—*it is all we have.* And being all we have, let's get behind the UNO with applause instead of criticism.

The UNO is a voluntary association of national governments. For the most part those governments elect their rulers by the people voting freely. This being true, let me pose this question: When the governments elected by the people have so many faults, how can it be expected that those governments will select delegates to the UNO who are the last word in perfection? We can expect no more from our representatives in the UNO, than we can expect from our representatives in Congress, Parliament, Diet, or whatnot.

In this regard, there might be a thought in the United States making the delegates to the UNO federal employees rather than party appointees. Like many others, this nation is ruled by a two-party system. Currently, we have in power the Democratic Party. Perhaps that power will remain for years to come. Perhaps it will be changed to a Republican regime in a few years. Under the present system, our delegates to the UNO are responsible to the particular party in the saddle. To assure the world that we are intent upon the success of the UNO, it might be well to make delegates to the UNO the same as delegates to the Supreme Court—a federal affair, entirely removed from politics. Such a move might be a wholesome influence upon the other nations who currently work under a "party" system.

But getting back to this matter of criticism: there may be a very legitimate conflict between the God of things that are and the God of things that ought to be. But there is much to be said for going ahead with things as they are (and I am now speaking to the "realists"). This nation, with some fifty other countries, have through their national governments, joined in an effort to keep the peace. Perhaps if all the people of the world were ready to see themselves as true citizens of the world rather than as individualists, matters could be handled differently. But considering things as they are today—being very realistic about it—would it not be the better part of wisdom to applaud the UNO and to try to build up its work in the hope that some day, in some generation, it might become a better instrument of co-operation? Considering the fact that the UNO is the *only* instrument we have looking toward international peace, is not applause far better than carping criticism?

PAPER MILL REPORTS:

"Phenomenal Service" from LINK-BELT

Silverstreak SILENT CHAIN DRIVES

Link-Belt Silverstreak Silent Chain Drives in operation at the Glassine Paper Company plant, West Conshohocken, Pa., include the following:

A 60 h.p. drive, installed in 1934, operating continuously 24 hours per day, 6 days per week.

Two 60 h.p. drives installed in 1936, same service.

A 75 h.p., an 80 h.p., and a 125 h.p. drive, installed in 1938 and running continuously.

That these drives have operated without attention other than inspection and lubrication, moved the chief engineer of the company to describe their service as "phenomenal."

Silverstreak Silent Chain Drives are engineered and built for positive, efficient service, long life, and low overall cost. Reports such as the above show that "performance fulfills the promise."

● Performance reflects the qualities engineered and built into Silverstreak Silent Chain Drives. Basic principle and details perfected through decades of experience and research, result in an efficiency of over 98 per cent. Rigid standards of quality in materials and precision methods of manufacture account for the long life, sustained efficiency and over-all economy. Their first cost is low, often lower than V belt drives, their cost per year of service is always lowest. Link-Belt silent chain drives are in operation today after 10, 20, or 30 years of service, with practically no attention or upkeep.

Today's demand for greater production efficiency suggests the wisdom of investigating the advantages of this distinctive drive. Write today for Data Book 125.

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices, Factory Branch Stores and Distributors in Principal Cities.

10,125

Eliminate SLIP!

PUT TEETH IN YOUR DRIVES!

LINK LB BELT

Silverstreak

SILENT CHAIN DRIVE

STEIN-HALL *offers counsel...*

What are your peacetime problems? Do you need counsel on the best starch method for your starch kitchen . . . on what type starch to use at a particular time or for a particular purpose? Are you studying material and equipment problems? Whatever your problem, Stein-Hall paper men can help you find the answer.

Our paper technical field men know their stuff. They are plant-wise, thoroughly familiar with materials, equipment and production methods. They can tell you the type of starch best suited to your needs, and how to plan an economical, efficient, flexible set-up for maximum results.

Our superior starches, gums and dextrines for sizing, calendering, coating and adhesive uses can be major factors in solving your problems. Call on us for counsel which will help you to secure your share of peacetime business.

80 Years of Starch Service

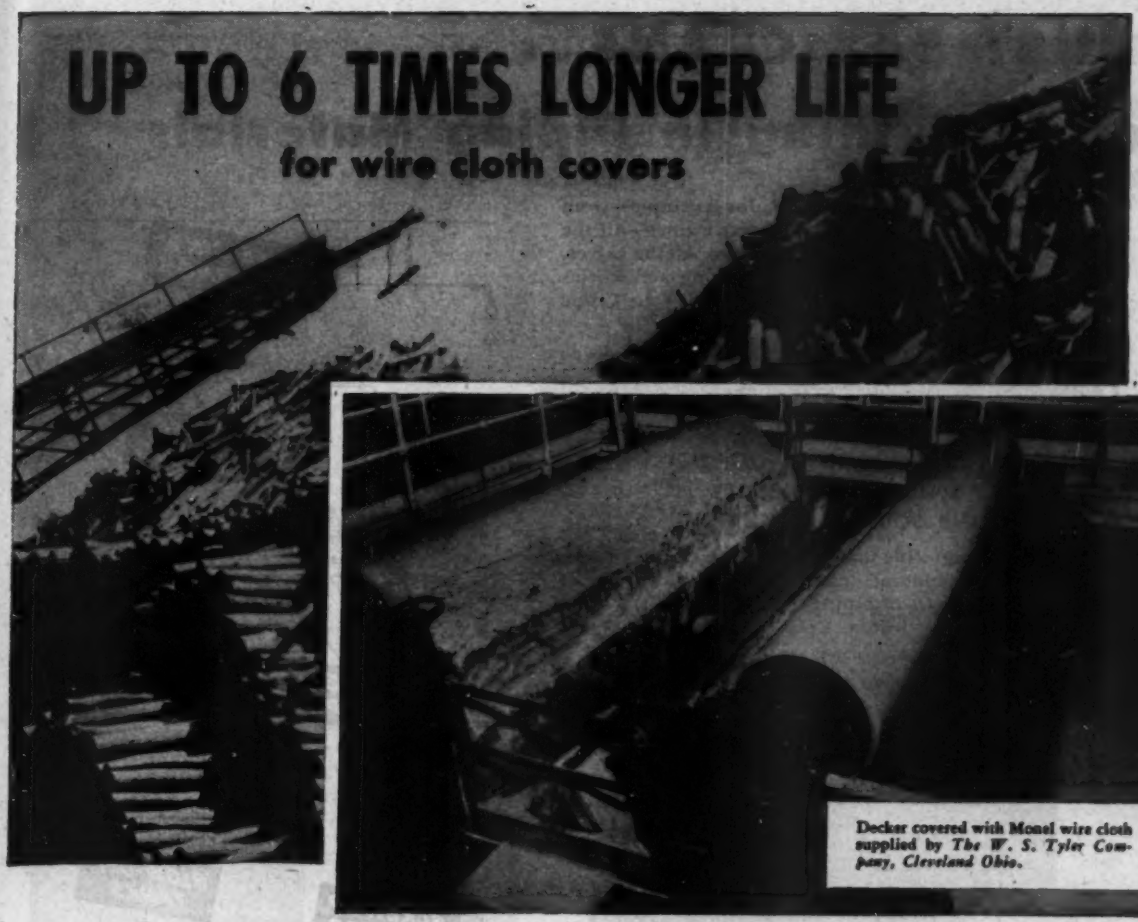
STEIN SH HALL

285 MADISON AVENUE
NEW YORK 17, N. Y.
OFFICES IN PRINCIPAL UNITED STATES CITIES AND AT: 290 VAN HORN STREET TORONTO, CANADA
LABORATORIES AT NEW YORK, CHARLOTTE, N. C., PROVIDENCE, R. I., CHICAGO

FOUNDERS—STEIN-HALL RESEARCH FELLOWSHIP AT THE INSTITUTE OF PAPER CHEMISTRY, APPLETON, WIS.

UP TO 6 TIMES LONGER LIFE

for wire cloth covers



Decker covered with Monel wire cloth supplied by *The W. S. Tyler Company, Cleveland Ohio.*

Life of wires on ground wood deckers or thickeners has been increased . . . *as much as 500%!*

And here's proof . . . from the report of a technical survey undertaken by producers of ground wood.

This impartial study indicates that Monel wires on deckers or thickeners last from 2 to 6 times longer than ordinary wire covers. The *average* increase in service life is 275%.

Monel's record in other types of pulp and paper mill equipment is equally good. For brown stock washers and alkaline bleached pulp washers . . . for wet machines and lime sludge filters, Monel outlasts conventionally used non-ferrous metals.

Not only does Monel wire cloth stay on the job longer, it permits fast, improved production and has an undeniably important effect in reducing maintenance charges. Moreover, the *cost* of Monel is *lower* than that of any wire cloth having comparable corrosion resistance and strength.

For your essential requirements, specify Monel. It is produced by all established weavers of wire cloth for pulp and paper mill services.

A vast amount of data which men in the industry have found helpful, is contained in Bulletin C-3 *"Monel, Nickel and Inconel in Pulp and Paper Mills."* There are sections dealing with chemical pulping, refining of stock, paper machine rolls, caustic and chemical recovery processes and pumping equipment. A request on your business letterhead will bring a copy to your desk. Write for it . . . now.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

MONEL

NICKEL (INCO TRADE MARK) ALLOYS MONEL* • "K" MONEL* • "S" MONEL* • "R" MONEL* • "KR" MONEL* • INCONEL* • "Z" NICKEL* • NICKEL
*Reg. U. S. Pat. Off.

JUST SAY CRANE . . .

For Everything In Piping Materials

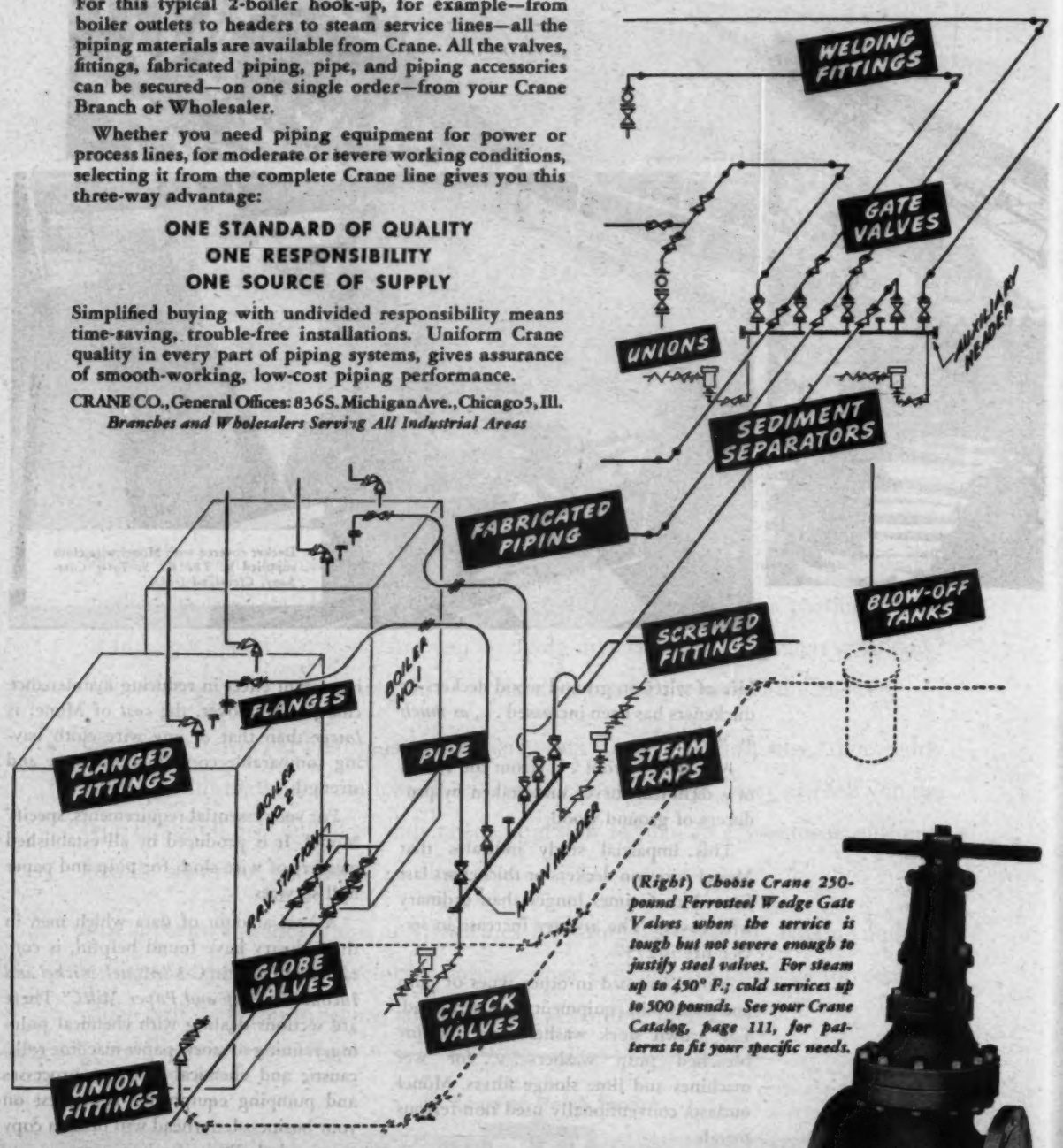
For this typical 2-boiler hook-up, for example—from boiler outlets to headers to steam service lines—all the piping materials are available from Crane. All the valves, fittings, fabricated piping, pipe, and piping accessories can be secured—on one single order—from your Crane Branch or Wholesaler.

Whether you need piping equipment for power or process lines, for moderate or severe working conditions, selecting it from the complete Crane line gives you this three-way advantage:

ONE STANDARD OF QUALITY
ONE RESPONSIBILITY
ONE SOURCE OF SUPPLY

Simplified buying with undivided responsibility means time-saving, trouble-free installations. Uniform Crane quality in every part of piping systems, gives assurance of smooth-working, low-cost piping performance.

CRANE CO., General Offices: 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas



(Right) Choose Crane 250-pound Ferrosteel Wedge Gate Valves when the service is tough but not severe enough to justify steel valves. For steam up to 450° F.; cold services up to 500 pounds. See your Crane Catalog, page 111, for patterns to fit your specific needs.

. . . EVERYTHING FROM

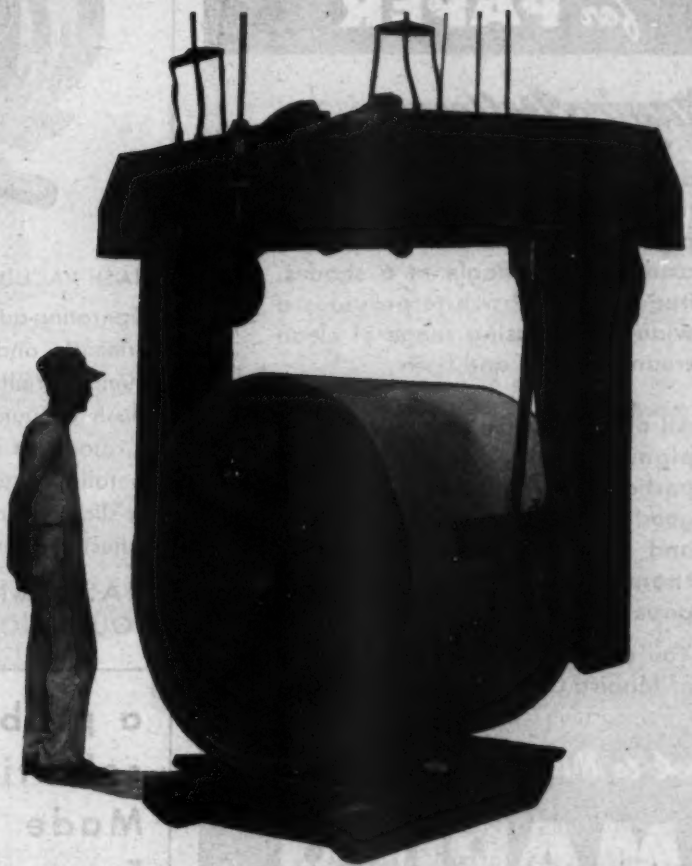
CRANE

VALVES • FITTINGS
PIPE • PLUMBING
HEATING • PUMPS

FOR EVERY PIPING SYSTEM

this motorized roll grab handles

6000-lb. ROLLS



ROLLS weighing up to 6000 lbs., from 24 inch to 60 inch diameter, and up to 72 inches long are handled by this Cleveland Tramrail motor-driven roll grab.

All grades and thicknesses of paper from light crepe, tissue and felt, to kraft and hard box-board, are safely handled without telescoping or damage. Motorized turn-over mechanism turns rolls from vertical to horizontal position, or vice versa.

Twelve installations employing grabs of this type for rolls from 900 lbs. up, are now in successful operation, saving from 50% to 150% storage space and effecting sharp handling economies.

GET THIS BOOK!

BOOKLET No. 2008. Packed with valuable information. Profusely illustrated. Write for free copy.

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
1165 East 283rd St. Wickliffe, Ohio

CLEVELAND TRAMRAIL
OVERHEAD MATERIALS HANDLING EQUIPMENT

Permanent

YELLOWS *for* PAPER

Mapico Yellows...

are light-fast and highly resistant to acids and alkalies. These fine pigments are pure precipitated iron oxides . . . available in 6 shades. Reduction with white provides a wide and pleasing range of clean creams, ivories and buffs.

All of the Mapico Colors are ideal pigments for papers. Their fine particle size, high tinting strength, good fiber adhesion, soft texture and permanent color have made them favorites throughout the paper industry.

You can depend on the uniformity of Mapico Colors.

Look to MAPICO *for Leadership*

MAPICO *Colors*

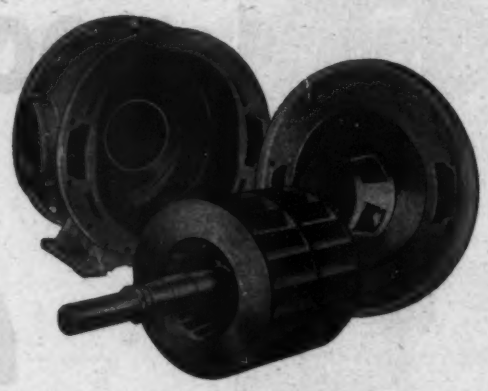
PURE OXIDES OF IRON

YELLOWS • REDS • BROWNS • BLACK

We will gladly send samples and complete technical information.

COLUMBIAN CARBON COMPANY
MAGNETIC PIGMENT DIVISION
MANUFACTURER
BINNEY & SMITH CO., *Distributor*
41 East 42nd Street • New York 17, N. Y.

SIMPLICITY



NASH VACUUM PUMPS HAVE ONE MOVING PART

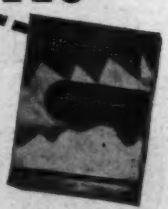
Operating advantages made possible by the Nash principle, and present in no other type of vacuum pump, permit a new level of operating economy. Nash Vacuum Pumps have but one moving part, a rotor cast in one piece, and revolving without metallic contact. There are no valves, no pistons or sliding vanes, no internal parts requiring wear adjustment or lubrication.

NASH ENGINEERING COMPANY
SOUTH NORWALK, CONNECTICUT, U. S. A.

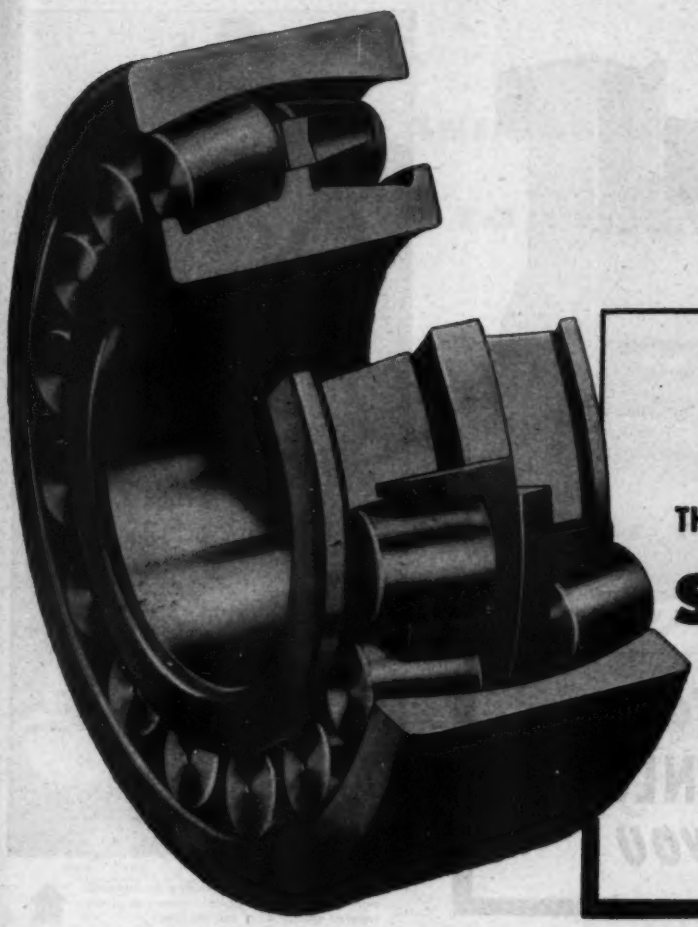
a problem in selection Made Easy

SPRAY NOZZLES

Whatever the application, whatever the type spray nozzle required, selection of the *exact* nozzle is now an easy job. The Spraying Systems catalog gives complete specifications on thousands of nozzle types and sizes. See how the right nozzle can improve your operations. Write for Catalog No. 22.



SPRAYING SYSTEMS COMPANY
4021 G West Lake Street • Chicago 24, Illinois
SPECIALISTS IN THE DESIGN AND MANUFACTURE OF SPRAY NOZZLES



Announcing

THE TORRINGTON SELF-ALIGNING

SPHERICAL ROLLER BEARING

In addition to the many advantages provided by Torrington's proficient engineering and precision manufacturing, the new Torrington Spherical Roller Bearing offers these features:

- Self-Alignment
- Two-Directional Thrust
- High Radial Capacity
- High Thrust Capacity
- Unit Construction for Easy Installation

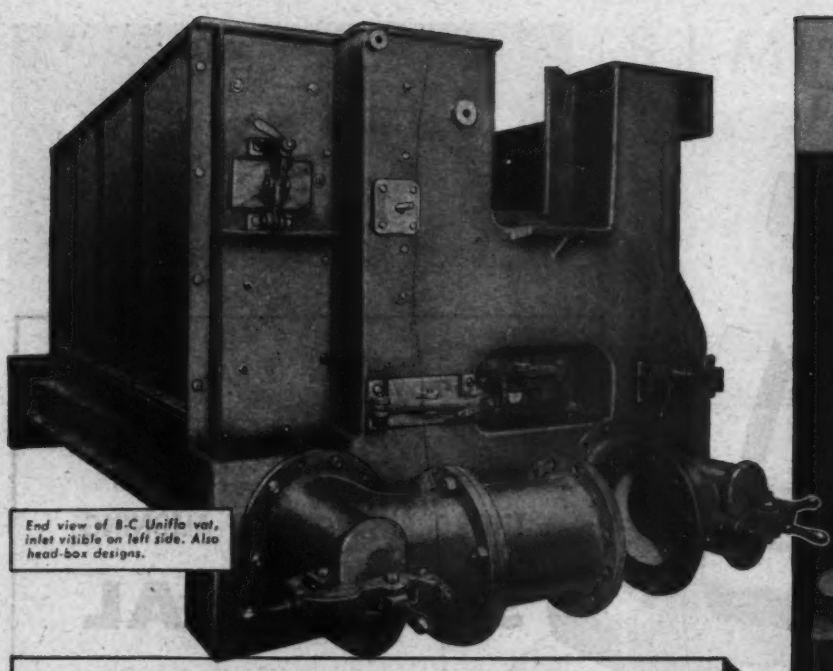
To meet the increasingly exacting demands of industry, Torrington has added to its regular line a bearing specifically adaptable to heavy-duty performance... the Self-Aligning Spherical Roller Bearing.

This new bearing will be available in a full range of sizes from 1.5748" bore and up. It is backed up by the same specialized engineering knowledge which for years has made Torrington's Bantam Bearings Division a leader in the design and construction of custom-built bearings. For further information write for our Bulletin No. 100A.

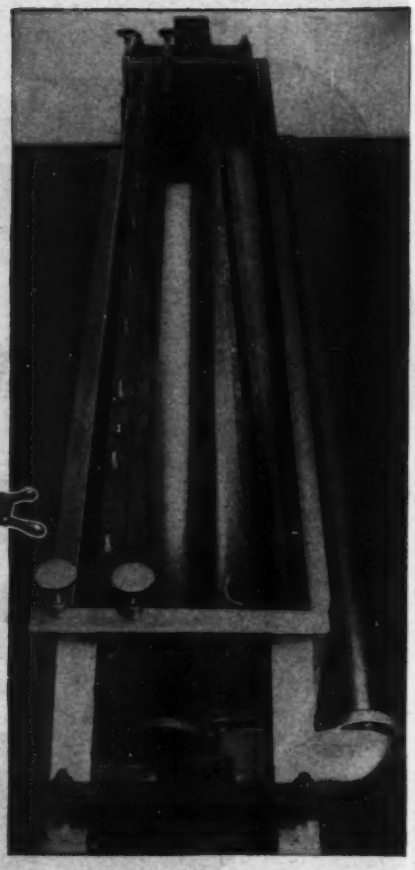
THE TORRINGTON COMPANY • BANTAM BEARINGS DIVISION
SOUTH BEND 21, INDIANA

TORRINGTON BEARINGS

SPHERICAL ROLLER • STRAIGHT ROLLER • TAPERED ROLLER • NEEDLE • BALL



End view of B-C Unifio vat, inlet vitible on left side. Also head-box designs.



A secondary headbox utilizing hydronamic principle. Note parallel openings from tapered ducts. Also vat designs.

BLACK-CLAWSON
HYDRONAMIC INLETS
WOULD HELP YOU

This new type "Inlet"—new in principle but old in service—would benefit your operation on head box or vats in many ways.

More level sheet.
Much stronger formation.
More even caliper.

Give you saleable paper more promptly after Monday morning start-up due to greater ease of manipulation—better control.

Faster wash-up when changing grades, hence less time lost.

Also important: B-C Inlet can become a pressure inlet, i.e., give you compact equipment even on high speed machines.

Have us explain still more fully. You can not afford to do less.

B-C Unifio vat with "Inlet" incorporated in design. Also designs for head boxes.

THE BLACK-CLAWSON CO., Hamilton, Ohio

Div. SHARTLE BROS. MACHINE CO., Middletown, Ohio
DILTS MACHINE WORKS, Fulton, New York
Associate ALEXANDER FLECK LIMITED, Ottawa, Canada

Covered by following patents: U.S. No. 2,347,717 and 2,347,830; Canadian No. 415,149 and 415,004.

ARMOUR'S ANIMAL GLUE

IS SURE EASY TO PREPARE

that's right, Mister...

You can use Armour's Animal Glue *without complicated chemical additions!* Merely mix with water, melt and use.

and that's not all...

Remember this about Armour's Animal Glue

- Easy to prepare
- Easy to use
- Completely uniform
- Pure, clean, clear
- High jelly strength
- Chemically inactive
- Tough and pliable
- Does not deteriorate

Important: At present, demand for many grades of Armour's Glue exceeds supply. However, we'll gladly discuss your problems to help you make *more efficient use* of the glue that is available.

Armour's Animal Glue has no impurities . . . It is commercially clean, clear, and one hundred per cent glue. This purity, plus high jelly strength, viscosity and tensile strength, means better sizing.

It's particularly good for beater and surface sizing... Chemically inactive on paper—no oxidizing, discoloring, flaking or shedding. It's grease-free . . . tough, pliable, light in color and clear . . . especially adaptable to top quality products.

It's absolutely uniform . . . The careful, scientific controls in making Armour's Animal Glue *guarantee* complete uniformity . . . help assure efficient, uninterrupted production in your plant.

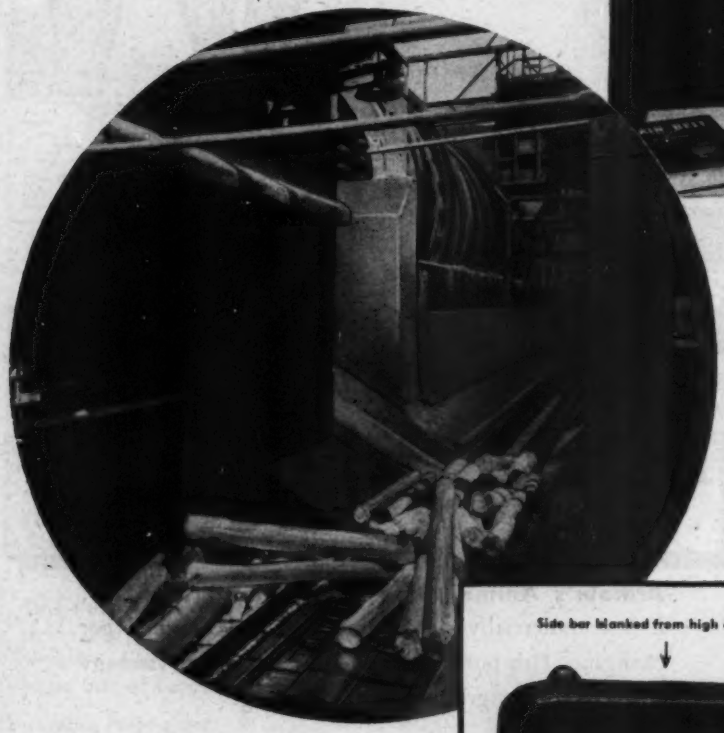
Armour GLUE Division

MANUFACTURERS OF HIDE GLUE, BONE GLUE, FLEXIBLE GLUE, SOLUBLE DRIED BLOOD, BLOOD ALBUMIN

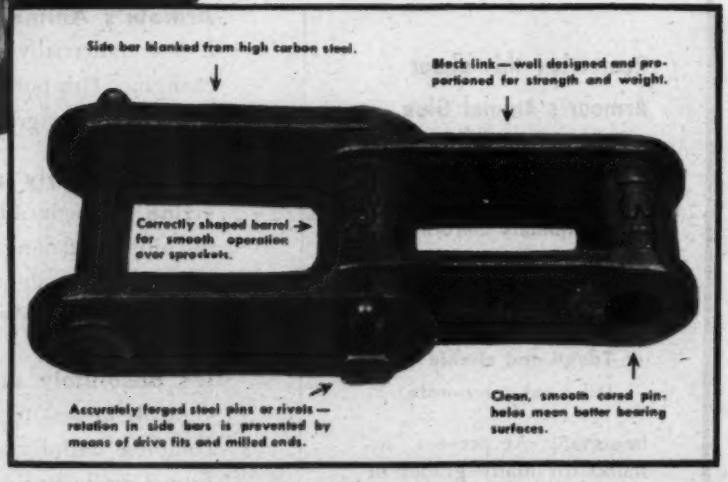
1355 WEST 31ST STREET • CHICAGO 9, ILLINOIS

DO YOU KNOW THE COMBINATION FOR BETTER PULP LOG CONVEYING?

① **IT'S REX COMBINATION CHAIN,** the chain belt that adds years to the life of your pulp log conveyors.



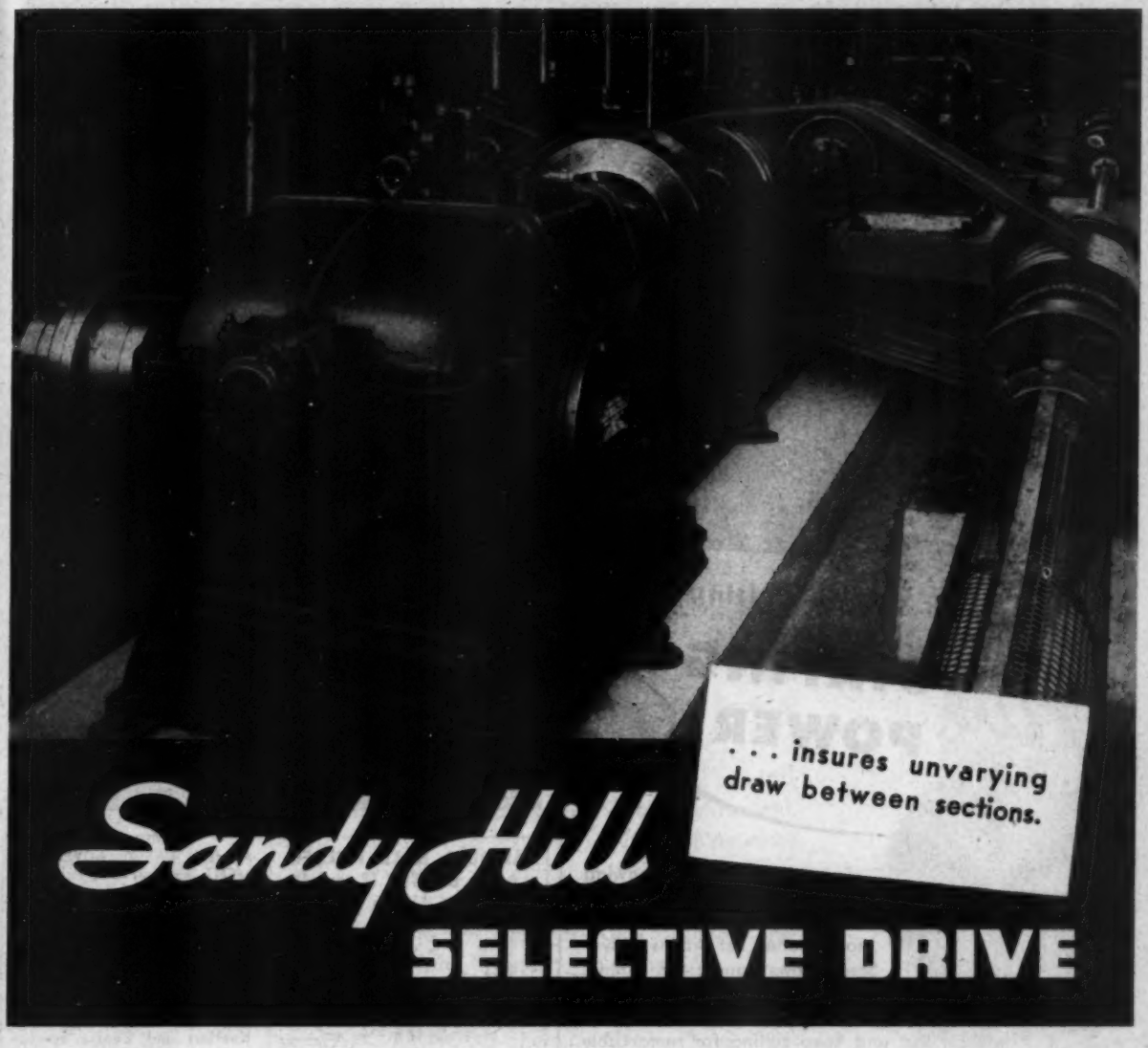
② **THE HEAVY POUNDING** of dropping logs and the sliding of the chain in the runways do not affect the performance of Rex combination chain. If wear does take place, the sliding links can be turned over, virtually doubling the life of the conveyor. And for exceptionally severe service . . . the cast block links are furnished in Rex Z-Metal with heat-treated pins.


Side bar blanked from high carbon steel.
Block link — well designed and proportioned for strength and weight.
Correctly shaped barrel for smooth operation over sprockets.
Accurately forged steel pins or rivets — rotation in side bars is prevented by means of drive fits and milled ends.
Clean, smooth cored pinholes mean better bearing surfaces.

③ **NOTE THE DESIGN FEATURES** listed in the close-up at the right. Steel side bars are accurately punched for correct pitch and good drive fits. Milled flats on pin ends prevent the pin from turning in the side bar. Attachments are available for all types of conveyor work. For complete details, see your Rex man, or write us direct.

REX CHAIN BELTS *manufactured in every available type for the positive transmission of power, timing of operations and conveying of materials*

CHAIN BELT COMPANY OF MILWAUKEE • 1714 W. Bruce Street, Milwaukee 4, Wis.



Sandy Hill SELECTIVE DRIVE

Savings in belt costs through longer belt life.

Greatly reduced maintenance costs.

Requires no basement or mezzanine; saves floor space.

Saves cost of structural steel for supporting line shaft or cost of piers.

Permits installation of relatively smaller line shaft with anti-friction bearings for power savings.

Fine draw regulation, exact draw maintenance — those indispensable requirements of paper machine operators—are assured by this new achievement of Sandy Hill engineers. Combines simplicity of design with trouble-free operation, power-saving economy, safety and low first cost.

Unvarying draw between sections is provided through Sandy Hill's particular design involving effective use of V-belts and sheaves. There is no detectable slippage in the V-belt feature of the drive, and the speed regulation made possible by the variable pitch V-belt sheaves is beyond the range of other mechanical combinations. Gives twice the draw range of the cone pulley and flat belt.

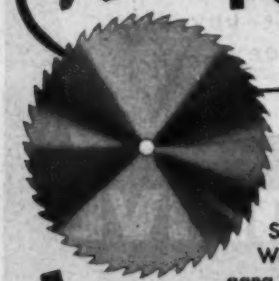
Sandy Hill Selective Drive can reduce operating costs for you. Write for circular showing drawings and explaining construction details.

THE SANDY HILL IRON & BRASS WORKS
HUDSON FALLS, N. Y.

ATKINS

For High-Speed Cutting

PLUS STAYING POWER



To hold down costs on sawing operations, do as pulp producers throughout the nation have done: Let Atkins "Silver Steel" Saws handle the cutting. Whether operated singly or on gang slashers, Atkins Circular Saws will cut fast and keep cutting for remarkably long periods.

Their keen teeth hold a sharp edge longer . . . require a minimum of filing. Available in all patterns and points. Write for complete information.

ATKINS CROSSCUT SAWS

Among Atkins quality tools for the paper industries are "SILVER STEEL" Crosscut Saws. Shown at left is the No. 9, one of numerous one and two man crosscuts in the line. Full details sent on request.

E. C. ATKINS AND COMPANY
402 S. Illinois Street, Indianapolis 9, Indiana
Agents or Dealers in All Principal Cities the World Over

"Soft droppes of raine perce the hard marble"
—JOHN LYLY

REPEATED often enough, flaws in a product can all too easily deface the long-established prestige of a manufacturer. Good will, on the other hand, is erected only by attending to uncounted millions of details which, through the years, have over and over again "gone right". We at Lindsay have long since decided that building is a far more pleasant process than wearing down.

THE LINDSAY WIRE WEAVING COMPANY
Serving the Paper Industry Since 1903
14001-14299 Aspinwall Avenue • CLEVELAND 10, OHIO

Lindsay **WIRES**

APMEW BALE PULPER AND BEATER (Patented)

A Good Investment
which in many Paper Mills returns its cost two times every year.

APMEW LARGE ADVERTISEMENT in Paper and Pulp Mill Catalogue, may be on your desk.

Request information which may result in GOOD EARNINGS to you.

Pulp Screens
Knotters and Coarse Screens
Agitators for Chests
Beaters and Pulpers
Pulp Thickeners
Proportioning and Metering Systems

AMERICAN PAPER MACHINERY AND ENGINEERING WORKS, INC.
P. O. Box 1, Glen Falls, N. Y.

COLORS . . .
for Board and Paper

Green Chromium Oxides
Black, Brown, Red, Yellow Iron Oxides
Lamp Black—Umbers—Venetian Reds—Yellow Ochres

C. K. WILLIAMS & CO.
Easton, Pennsylvania

"HOOPERWOOD ENGINEERED"

Dryer Clothing

Meets Each Mill's Specific Needs

No single type of Dryer Felt will suit the requirements of all mills—or even all positions on the same machine.

That is why HOOPERWOOD "Canvas Engineering," which has produced not one but several distinct types of Cotton and Asbestos Felts, has been of real assistance to many Paper Mill Superintendents.

Therefore, if it is a rugged, heavy felt you need for fine finish in normal production . . . or a lightweight, extra-porous felt for faster drying . . . or an Asbestos felt to withstand the advanced temperatures involved in high-speed production of Kraft and other heavy papers — HOOPERWOOD "Canvas Engineering" has the answer to your problem.

And for your Carrier Rope requirements, specify HOOPERWOOD-Sheahan Carrier Rope. Until Hooper engineers designed this high-grade product, rope of comparable quality was obtainable only from foreign sources.

WM. E. HOOPER & SONS CO.

New York **PHILADELPHIA** Chicago

Mills: WOODBERRY, BALTIMORE, MD.

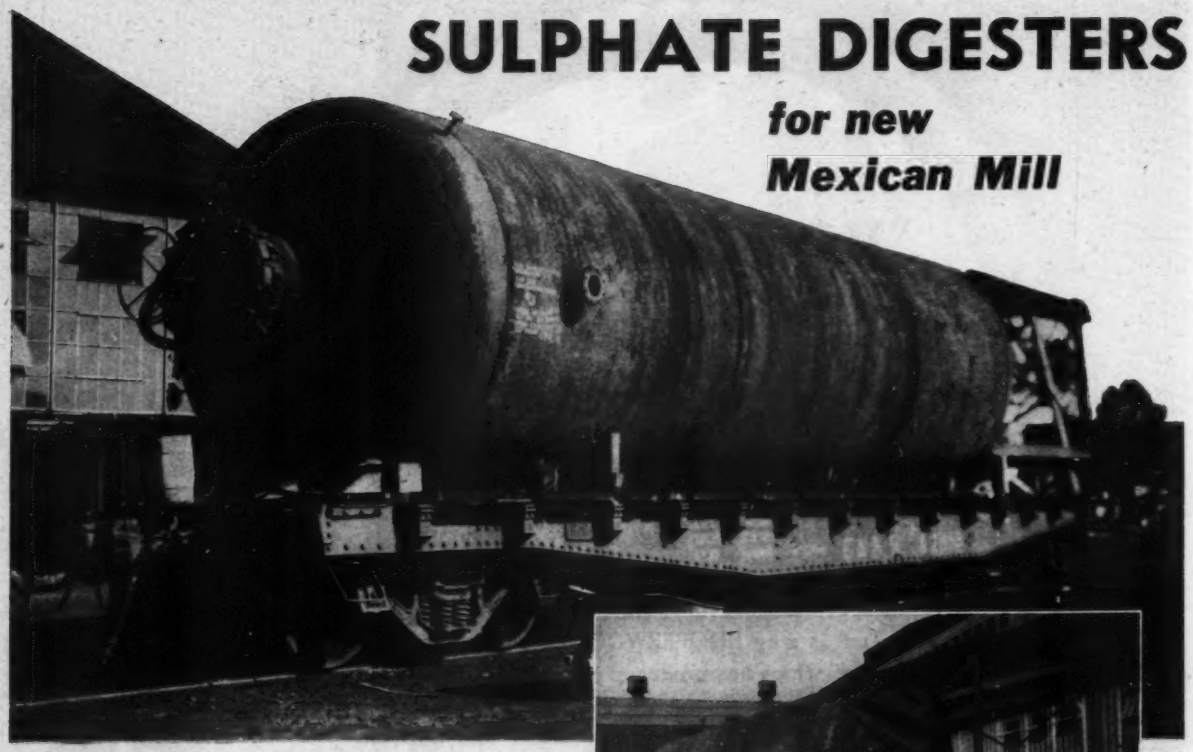
Since 1800 (through six wars) the HOOPER name has symbolized highest quality in Cotton Duck and other Heavy Cotton Fabrics, Paper Mill Dryer Felts, Filter Cloth, Rope, Sash Cord.

HOOPERWOOD DRYER FELTS

COTTON AND ASBESTOS

SULPHATE DIGESTERS

for new Mexican Mill



WE recently designed and fabricated two sulphate digesters for a pulp mill in Mexico. The views on this page show one of them being loaded for shipment from our Birmingham plant. Normally the posts supporting digesters are shipped separately. In this case, however, they were completely assembled and attached directly to the digesters.

Sulphate digesters are just one type of steel plate work we are furnishing to the paper industry. Others include bins, diffusers, steel smoke stacks, cylindrical tanks, and flat-bottom storage tanks. All of our plants have facilities for stress-relieving in accordance with Paragraph U-68 of the A.S.M.E. Code for Unfired Pressure Vessels. We also have facilities for X-raying.

Write our nearest office for quotations the next time you need steel plate work.

ANOTHER EXAMPLE OF THE COMPLETE PLATE WORK SERVICE AVAILABLE AT OUR PLANTS FOR THE PAPER INDUSTRY.

To facilitate erection at the mill, the structural supports were attached to the two sulphate digesters before they left our plant. This sketch shows how the digesters look installed

CHICAGO BRIDGE & IRON COMPANY

Chicago, 4.....2445 McCormick Building
New York, 6.....3350-165 Broadway Building
Cleveland, 15.....2267 Guildhall Building
Los Angeles, 14.....1459 Wm. Fox Building
Birmingham, 1.....1511 North 50th Street
Atlanta, 3.....2143 Healey Building
Plants at BIRMINGHAM, CHICAGO and GREENVILLE, PENNA.

Tulsa, 8.....1651 Hunt Building
Houston, 1.....5643 Clinton Drive
Philadelphia, 3.....1653-1700 Walnut Street Building
Washington, 4.....703 Atlantic Building
San Francisco, 11.....1217-22 Battery Street Building
Detroit, 26.....1566 Lafayette Building
In Canada: HORTON STEEL WORKS, Limited, FORT ERIE, ONT.

THE PAPER INDUSTRY
and PAPER WORLD
FEBRUARY, 1946

Microcrystalline Waxes—Their Manufacture, Properties and Uses in the Paper Industry

BRUCE H. CLARY, Wax Division
Bareco Oil Company

▶▶▶ FOR THE PAST forty years, paraffin wax has been a very important raw material to the manufacturer of food protection papers. More recently another product of the petroleum industry — microcrystalline wax — has been arousing the interest and attention of packaging engineers and paper converters. Although this product was produced by oil refiners as early as 1926, its true worth was not generally recognized or its excellent properties utilized until the packaging demands of global war began to make themselves felt early in World War II.

Momentous military uses developed in rapid succession, some assuming very large proportions both in tonnage and in strategic importance. The protection of ordnance spare parts during their long journey from their place of manufacture to the front lines of Africa, Europe and the Pacific, was dependent upon Grade C Ordnance Wrapping materials and Dip Sealer Compound, both tremendous users of microcrystalline waxes. The outside coating on Rations K and Ten in One was composed of an equal mixture of paraffin and microcrystalline wax. A later development was the laminated Ration K overwrap, another large user.

As the production of mircrocrystalline waxes became inadequate to supply such military uses as well as other established civilian uses, these products were placed under allocation control on July 1, 1943, to assure distribution in the proper channels, to promote conservation among the users, and to encourage increased production. Through the splendid co-operation of the consuming industries in conserving and extending microcrystalline waxes and of the petroleum industry in increasing production, military needs were fulfilled completely. At the end of the war, microcrystalline wax was being produced at the rate of 90,000 tons a year — a tremendous increase over the some 25,000 tons produced in 1942.

Study of these comparative production figures reveals the state of the microcrystalline wax field at the close of the war. Already new applications are appearing and it seems certain that because of their many advantages, peacetime uses will soon equal in tonnage those of war.

Manufacture

The microcrystalline waxes manufactured in this country are produced mainly from either Mid-Continent or Pennsylvania crude oils. Waxes produced from Mid-Continent crudes are generally higher in melting point (155 Fahr. to 200 Fahr.) than those produced in Pennsylvania. The latter are characterized by low melting points (140 Fahr. to 155 Fahr.) and extreme

WAXED PAPER

Waxed paper was not used in the United States until about 1854, and even then it had only a very limited application in pharmacy. About 1865, however, a Philadelphia firm, noticing the increased consumption of the article, began to manufacture it on a larger scale, and at the same time substituted paraffin for the more costly beeswax which not only reduced the price but turned out a much superior paper. The sales, however, at this time did not exceed $150 per annum. The process or manufacture employed by the originators consisted of impregnating with paraffin sheets of paper spread upon heated surfaces. This plan was followed until the increased demand for the product rendered such methods inadequate. Accordingly, in 1877, these manufacturers invented a machine whereby the product could be more readily prepared, and at the same time a company was organized for the purpose of developing what gave evidence of being a business in itself. As the product was never patented, nor its preparation held a secret, several firms quietly adopted the idea.

They not only prepared it for their own use, but very probably also for sale, for when the paper was recognized as an article of commerce, competition was attracted to it from all sides. Various machines for its production were patented and for ten or twelve years incessant litigation for alleged infringement followed as a consequence. After spending much money, and experiencing many disappointments in the delays and decisions of the courts, the litigants finally concluded to harmonize, and form a trust or some agreement whereby peace should prevail. Thus, from being a product of only a few hundred dollars' worth at the outset, paraffined paper has become a staple article, at least $400,000 being annually consumed. In 1889, there were in various parts of the United States six concerns with an invested capital of $200,600 engaged in the manufacture of paraffined paper.—Journal of Pharmacy through "The Paper World," 32, No. 3:102, March, 1896.

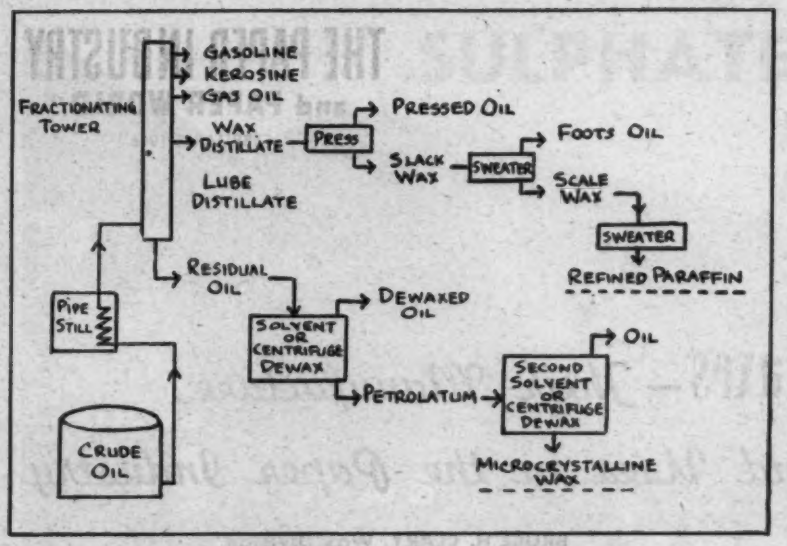


Fig. 1—Simplified flow chart. Manufacture of petroleum waxes

ductility, making them valuable in certain applications.

Petrolatum or petroleum jelly, removed from heavy lubricating oils to render them free-flowing at low temperatures, is the raw material used to manufacture microcrystalline wax. Petrolatum is removed from such oils by solvent separation or by centrifuging. The process of obtaining microcrystalline wax from petrolatum consists of de-oiling it by recentrifuging or by subjecting it to a subsequent solvent re-crystallization operation. The waxes thus produced are commonly dark in color thereby making a bleaching operation necessary if the wax is to be used in an application where color is a factor.

In Figure 1 the steps involved in the manufacture of microcrystalline wax are outlined and its place in the process of petroleum refining clearly shown. Here, too, one will note the position of paraffin wax, its processing and the fundamental difference in the sources of the two waxes. Microcrystalline waxes are produced from *residual* oils, whereas paraffins are produced from *distillates*. Hence, while both these waxes are produced from the same natural product — crude petroleum—and have many properties in common, they are separated from entirely different fractions. Therefore, the properties of microcrystalline waxes are sufficiently different from those of paraffin waxes to make possible an entirely new series of uses.

Properties

Usually overlooked in discussions of microcrystalline wax is the fact that the name denotes only one characteristic of the material. Numerous products in great variety are manufactured and marketed as microcrystalline wax, some of which bear little, if any, resemblance to others. The most common type is the plastic, ductile variety which is flexible in thin films and which is usually supplied in colors from black to amber. There is another type which can be described as brittle. It is much harder than the plastic type, having substantially higher melting points, being practically free from tack, and having a sharp, clean fracture. Intermediate grades are quite common, having a degree of plasticity, together with relatively high melting points. There is no specific dividing line, however, between the various types of microcrystalline waxes, and efforts to classify them have not been too successful. This wide divergence in specifications and properties in microcrystalline waxes is due to the different crudes run and the different processes used by the various manufacturers.

The use of the term "microcrystalline wax" alone to describe such an array of products has been unfortunate and the confusion resulting was not in any way relieved by the early practice of referring to these materials as "amorphous waxes." The first microcrystalline waxes produced were the plastic, ductile type carrying a considerable quantity of oil and being so novel in appearance that the term "amorphous" was used merely as an attempt to describe their physical properties as contrasted with crystalline paraffin. Later on it was discovered that they had a definite crystalline structure when studied under the microscope and that this structure differed greatly both in size and in character from that of paraffin. The contrast in the structure of petroleum waxes is shown in Figure 2, from which it can be seen readily why the word "microcrystalline" was soon adopted for the material produced from petrolatum. The term "amorphous wax" is rapidly falling into disuse as such a thing does not exist. Photomicrographic study reveals that petrolatum itself has a minute crystalline structure.

In spite of the fact that the term microcrystalline wax covers a vast range of materials greatly differing in many respects, they all have in common certain properties which render them useful such as low moisture vapor transmission and comparatively high melting points. The wide variation of materials in this category affords the user the choice of the wax most suited for any specific application.

It is generally well known that petroleum waxes — both crystalline (paraffin) and microcrystalline — are among the best organic materials known for resisting the passage of moisture vapor. The reasons for this excellent impedance are not fully understood but many theories have been advanced and much study has been made of this property. Attempts to explain the reasons for their behavior in this regard usually embrace the fact that petroleum wax is nothing more than solid oil and being such has one of the attributes of oil—almost complete inability to absorb moisture. Continuous films which cannot absorb moisture or moisture vapor certainly cannot transmit it through themselves.

In this connection much attention has been given to their crystal structure in which the marked difference is shown in Figure 2. This difference is thought to be due to a high boiling crystal inhibitor present in microcrystalline wax which is not contained in paraffin wax due to the relatively low temperature at which the paraffin distillate is removed in the refining process.

Vapometer tests prove that there is very little, if any, difference in the rates of transmission of moisture vapor through a film of paraffin wax as compared to the rate through one of microcrystalline wax when both films are perfectly flat and smooth. However, when they are creased, crumpled or folded which occurs in practically every packaging operation, plastic type microcrystalline wax films, or those containing a percentage of this material, afford much greater protection against moisture migration. This is due to the flexibility of films of this type of microcrystalline wax in contrast to those of paraffin which are quite brittle. This fortunate combination of moisture vapor resistance and flexibility (which is retained at low tempera-

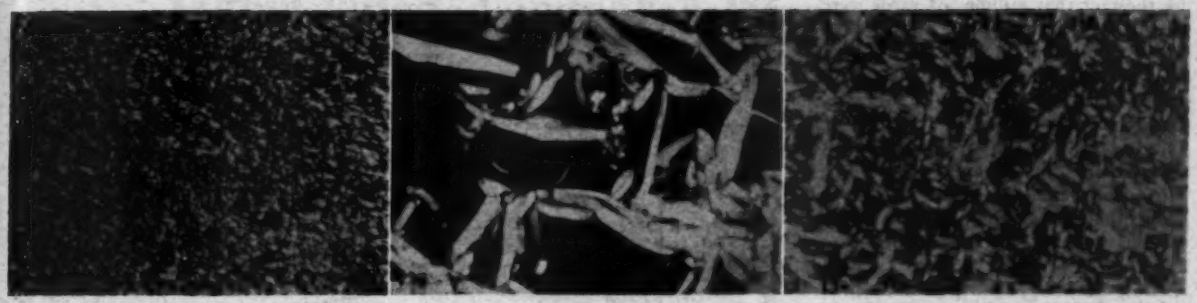


Fig. 2—Photomicrographs of petroleum waxes and blends (200 X magnification—polarized light—room temperature). A (left)—Microcrystalline wax—melting point 190-195; B (center) Paraffin wax—fully refined. Melting point 133-135 A.M.P.; C (right) Blend of 95 per cent paraffin wax (133-135 m.p.) and 5 per cent microcrystalline wax (190-195 m.p.)

tures) has made possible many of the present uses of microcrystalline wax.

Because high boiling residual oils are the starting products in the manufacture of microcrystalline wax, the melting points of the resulting materials are much higher than those of lower boiling paraffin wax. Melting points between 140 Fahr. and 175 Fahr. are most common in microcrystalline waxes although some are commercially available having melting temperatures of 190 to 200 Fahr. The property of high melting point is another attribute of microcrystalline wax not usually found in paraffin wax. This characteristic is valuable in blends with other materials and in many applications wherein microcrystalline wax is used alone.

Always of vital interest to the paper converter is the factor of odor and taste in his raw materials especially when such might affect the product being packaged. In paraffin waxes, taste and odor are usually due to the oil content and when this is kept to a minimum (usually under 0.5 per cent in fully refined wax) a material practically free from these objectionable features results. A much more complex problem is involved in producing odorless, tasteless microcrystalline wax. First, the oil contained therein has a great affinity for the wax itself and cannot be separated from it by sweating—the means usually employed in de-oiling paraffin wax. Second, the amount of oil in a microcrystalline wax is one of the factors which control its penetration or hardness. Any change in oil content usually is accompanied by a similar change in ductility, hardness, and adhesive qualities. Hence, in order to produce an odorless, tasteless microcrystalline wax with plastic, ductile properties, it is necessary to deodorize the wax and the oil together rather than simply to remove the oil. Methods of accomplishing this have been perfected however, and microcrystalline waxes free from odor and taste are being marketed at the present time.

Microcrystalline waxes, especially those in the melting range 140/165 Fahr. and the penetration range 25/35, possesss excellent adhesive qualities useful in laminating and in pressure-sensitive wraps. This quality diminishes as the melting point increases and the penetration decreases. These factors can well serve as a guide in the selection of the proper wax for such applications.

Other properties of microcrystalline waxes not generally recognized but of vital importance in all applications, are their rapid change from a solid to to a liquid at their melting point temperatures and their low viscosity immediately above their melting points. Without these properties many of today's applications would be well nigh inoperable. This is particularly true in paper converting where coating and laminating are the standard methods of application.

Uses

Since resistance to the passage of moisture vapor is the foremost property of microcrystalline wax, it is no wonder that the paper industry is its largest consumer. Several different methods are employed in applying waxes to paper—by coating a continuous film on the surface in the case of wet-waxed paper, by dispersing the wax in the paper itself in the case of dry-waxed paper, and by forming a layer of wax between two sheets of paper in the case of lamination.

The manufacture of wet-waxed paper is carried out in such a manner that much of the wax remains on the surface of the paper forming a continuous moisture vapor barrier. Paraffin is the major wax used in wet-waxed papers, but as it is quite brittle the use of it alone leaves much to be desired in performance in the case of certain specific applications. If any rupture occurs in the film of wax such as would be expected from creasing, crumpling or marring, the fibers of the paper underneath will become exposed to the air and their wicking action will soon transfer moisture vapor through the sheet. Paraffin wax films can be greatly enhanced in ductility and flexibility by the addition of 5 to 25 per cent of plastic type microcrystalline wax. This is especially advantageous in the case of frozen food wrappers where the low handling temperatures tend to increase materially the brittleness of the film.

The exacting requirements of Ordnance overseas packaging made necessary the use of a special type of wet-waxed paper, which is popularly designated as Grade C Ordnance Greaseproof Wrapper. This material was used in tremendous quantity during the war and thousands of tons of microcrystalline wax were consumed in its manufacture. The specifications for Grade C Wrapper require that the material be moldable and sealable as well as greaseproof, acid-free and noncorrosive. Greaseproof sheets are employed as the base, and straight microcrystalline wax is coated thereon to make the product moldable and sealable. In wrappers where high bursting and tearing strength is necessary, the greaseproof sheet, usually "cellophane" or cellulose acetate, is laminated to cotton scrim. Such wrappers, designated as Grace C, Type I, contain from .5 to .6 pound of microcrystalline wax per square yard.

The functions of these wrappers were to protect the thin preservative oil coating, which was applied directly to the part, from being ruptured and to protect the part itself from corrosion, dust and dirt. Its moldable, self-sealing property which was one of the contributions of the microcrystalline wax employed, made it possible for the wrappers to be creased, folded and bent, thereby allowing the material to conform to the shape of the object being wrapped. Such conforming wraps eliminated air pockets and afforded a continuous protective barrier which sealed to itself with the application of light pressure.

The extent to which these materials were used during the war is indicated

by the fact that millions of yards were produced monthly when steady production was established. The type of microcrystalline wax used was so exacting and the need for it so large, that Grade C Wrappers were one of the principal reasons for the allocation of microcrystalline wax in wartime.

Another fast growing use for microcrystalline wax in the manufacture of wet-waxed papers consists of adding small percentages of the brittle, high melting point types to paraffin, which raises substantially the melting point of the film formed, increases its hardness and durability, and improves its heat-sealing properties. The ability of microcrystalline wax to raise the melting point of paraffin wax is quite surprising and of great value in this application. Figure 3 shows the effects on melting point and penetration resulting from the blending of any quantity of 190/195 melting point microcrystalline wax with 133/5 A.M.P. paraffin wax. It will be noted that as little as 5 per cent of the microcrystalline wax raises the melting point of the blend to 150 Fahr. The crystalline structure of such a blend is shown in Figure 2C.

Dry-waxed papers are those having a degree of water repellency but not any particular impermeability to moisture vapor. The reason for this difference is found in the application of the wax as compared to that in wet-waxed paper. As we have seen, the latter material consists of a continuous film of wax, whereas dry-waxed paper merely has wax dispersed throughout the sheet with no attempt at continuity. In the manufacture of dry-waxed papers, a thin film of wax is applied to the base paper and by a heat treatment immediately following, the wax thus applied is driven into the sheet. Because of this treatment very little wax is left on the surface. Butchers' wraps, delicatessen wraps, sandwich wraps, soda straws and the like are examples of dry-waxed papers.

By far the largest use of microcrystalline wax in the paper industry is in the manufacture of laminated papers. The process of laminating, formerly known as pasting, consists of combining two or more plies of material to form a single sheet by applying an adhesive material between the plies and then subjecting the whole to pressure.

Microcrystalline wax plays a dual role when employed in the manufacture of laminated papers. It not only acts as an adhesive with excellent bonding strength but also serves as a splendid continuous impervious moisture-resisting film. Plastic types of microcrystalline wax are the ones used for such combining as they are inherently adhesive and have the necessary degree of pliability required to produce flexible laminated sheets.

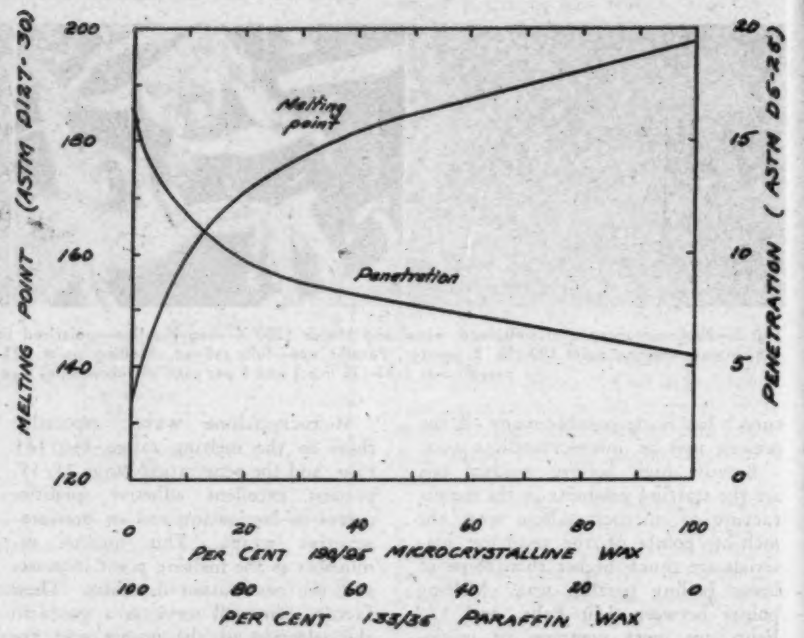


Fig. 3—Graph showing effect of blending paraffin wax and microcrystalline wax on melting point and penetration

The choice of the correct microcrystalline wax is of great importance in the manufacture of laminated papers, especially where one or more of the plies consists of a hard surfaced sheet, such as glassine, "cellophane," foil or other material which is not penetrated to any degree by the laminant. Usually employed is the plastic type of microcrystalline wax having a penetration test of 25/35 at 77 Fahr. as this grade seems to have the most satisfactory balance between cohesion and adhesion to produce the desired result — a combination of materials which can be separated only with great difficulty.

Lamination offers many advantages over other types of waxed papers. There being no single sheet having all the necessary qualities for adequate protective packaging, it offers an excellent means of combining several different materials to obtain the desirable qualities of each, at the same time having the ever-present moisture vapor barrier—adhesive combination of microcrystalline wax.

By selecting the type of sheet to be combined, many different functions of packaging material can be served. Greaseproof papers can be laminated to chipboard, glassine to glassine or foil, "cellophane" to any number of other materials or to itself. In all cases the wax film, completely protected between the plies, provides much added moisture vapor resistance.

An interesting laminated combination is found in the three-ply overwrap for the inner carton of Ration K developed for the Quartermaster Corps. In this case, aluminum foil is combined with two dissimilar sheets of paper by means of microcrystalline wax and the resulting laminated sheet overwaxed to give the required heat-sealing characteristics.

With so many possibilities for combinations of functional sheets, lamination with wax is expected to increase in importance. The packaging demands of frozen, dehydrated and processed foods in peacetime undoubtedly will call for increasing quantities of laminated materials.

Future Outlook

The war has proven the value and versatility of microcrystalline wax in the paper industry. It has become a familiar product to many paper converters who were manufacturing wartime packaging materials. Its increased production during that period assures ample supplies for peacetime uses. Improvements in these waxes will no doubt appear in the future. The pressing demands of war forced manufacturers to produce maximum quantity with minimum quality necessary to meet requirements. Improved heat-sealing properties, sharper melting points and greater flexibility at low temperatures can be anticipated when the refiner can devote his full attention to the quality of his products. Such improvements are expected to open new avenues to the paper converter in the utilization of microcrystalline wax.

Lignin-Filled, Laminated-Paper Plastics

A co-operative report of the U. S. Forest Products Laboratory,[1] the Howard Smith Paper Mills, Ltd., of Cornwall, Canada, the Canadian Department of Munitions and Supply, and the Forest Products Laboratories of Ottawa, Canada.

▶▶▶ A NEW APPROACH for the utilization of lignin in the production of a strong laminated paper plastic was indicated by the results of preliminary work conducted by the Howard Smith Paper Mills, Ltd. of Cornwall, Canada. At the instigation of the Canadian Department of Munitions and Supply, a further investigation was conducted as a co-operative project at the U. S. Forest Products Laboratory. This investigation was directed primarily towards the establishment on pilot plant scale, of the most suitable procedure for handling and controlling the various operations involved, incorporation of desirable properties in the laminate, and the evaluation of the product for various war uses.

In the course of this investigation, it was found that, with the exception of edge compressive strength a high temperature thermoplastic lignin-filled paper laminate of equal or superior strength to the conventional phenolic laminates can be made.

Of special interest is its exceptionally high resistance to impact, which may be considered as a measure of toughness. Comparison with recently published test data by the Army Air Forces, Materiel Center, on fabric- and paper-base phenolic laminates indicates that the lignin-filled paper laminates have face Izod impact values three to six times greater than the other types. The edge impact values are approximately equal to those of fabric-base laminates and three times greater than those of the conventional paper-base laminates. Both face and edge impact values are two to three times greater than corresponding values for papreg (a high-strength phenolic laminate), although other strength properties thus far obtained are somewhat less.

Athough lignin is thermoplastic it has been found that the loss in tensile strength obtained when lignin filled laminates are heated to 200 Fahr. is not greater than that for thermosetting phenolic papreg. At low temperatures, the tensile strength of the lignin-filled laminate improves slightly over that measured at room temperature. There is some loss in impact strength both at high (200 Fahr.) and at low (subzero) temperatures, but even at these temperatures, the strength of the plastic compares favorably with that of other materials of this type even when they are measured under their most favorable temperature conditions.

In addition to the use of lignin as a filler in laminating paper for plastics, it has been found that it can be used as an extender for phenolic resins in impregnating varnishes for paper laminates.[2]

Manufacture of Lignin-Filled Paper Laminates

The process of manufacturing lignin-filled paper laminates comprises the following four steps:

(1) Isolation of lignin from the spent liquors of the alkaline pulping processes; (2) incorporation of the lignin in a papermaking furnish; (3) production of a moldable paper; and (4) conversion of the lignin-filled paper into a laminated plastic.

The lignin supplied by Howard Smith Paper Mills, Ltd., was produced from aspen wood soda-pulp black liquor in a pilot plant. The investigations conducted at the U. S. Forest Products Laboratory were concerned exclusively with the three remaining steps in the process.

Several schemes for incorporating the lignin with the pulp prior to its manufacture into paper were studied, two of which were reduced to practical and readily controllable procedures. One of these methods consists of mixing the pulp with an aqueous solution of the crude lignin and then precipitating the lignin in a water-insoluble form of suitable particle size and physical characteristics by means of dilute sulphuric acid. A temperature of 203 Fahr. (95 C.) and a pH of 3.0 was suitable for precipitation. The equipment used for this operation was a wood tank with a draft tube and centrally placed impeller to allow thorough mixing and agitation. Following the precipitation, the stock was washed by passing the mixture over a rotary vacuum filter to remove impurities which would cause excessive foaming on the paper machine. The excessive acid was neutralized with lime, to permit the use of a standard iron filter with iron auxiliary equipment.

The second method consists of precipitating the lignin directly from its solution, in the absence of the pulp, but obtaining the lignin in a physical condition similar to that obtained by the first method. By this procedure a finely divided purified lignin in the form of a paste or powder can be produced. In this form, lignin becomes available not only for use as filler in the paper furnish, but also as a coating material for augmenting the lignin content at the surface of the lignin-filled sheet. It is also in suitable form for use as an extender for phenolics in varnishes for impregnated-paper laminates. In most experiments of this type the pulp was added directly to the lignin without separating the lignin from the mother liquor. The resultant mixtures were washed on the rotary filter. In commercial production it should be possible to separate and wash the lignin in the absence of the pulp, thus producing purified lignin for mixing directly with the pulp in the paper mill beater.

The laminating paper was made on the Laboratory paper-making equipment. The pulp-lignin furnish prepared by either of the methods described was run to the paper machine in the usual manner. No unusual paper-making problems were encountered except those involving retention of the lignin in the paper. Relatively simple methods gave essentially complete retention of the lignin at all stages of the process. These methods were selective return of the white water and the use of glue and alum as flocculating agents. The results obtained indicate that the standard commercial fourdrinier machine, with only minor adjustments, is entirely suitable for the manufacture of this type of paper.

It was demonstrated that lignin-filled papers thus prepared can be laminated between open cauls, using moderate laminating pressures and a temperature (356 Fahr.) normally available at the paper-mill steam plant. It is necessary to cool the panel before removing it from the press. The pressures required for laminating are dependent on the lignin and moisture contents of the sheet.

(1) Maintained at Madison, Wis., in co-operation with the University of Wisconsin.

(2) U. S. Forest Products Laboratory Report No. 1595, "Properties of Laminated Plastics Made from Lignin and Lignin - phenolic Resin - impregnated Papers."

Table 1.—Physical and mechanical properties of lignin-filled, laminated-paper plastic from Run 37[1] (Plastic Nos. 2237, 2238 and 2239).

Panel number	Thickness[2]	Specific gravity	Conditioning procedure before testing	Moisture content of paper at time of lamination (Moisture free basis)	Tensile strength: Ultimate	Tensile strength: Proportional limit	Tensile strength: Modulus of elasticity	Edge compressive strength: Ultimate	Edge compressive strength: Proportional limit	Edge compressive strength: Modulus of elasticity	Flexural strength: Modulus of rupture	Flexural strength: Proportional limit	Flexural strength: Modulus of elasticity	Water absorption—24 hours: Wgt. increase	Dimensional change: Length	Dimensional change: Width	Dimensional change: Thickness	Forest Products Laboratory toughness	Rockwell hardness 10+100 kg.	Shear (Johnson): Flatwise[3]	Shear (Johnson): Edgewise[4]	Bearing strength (3/4 in. diameter pin) at 4% deformation of hole diameter	Impact strength (Izod): Panel number	Impact strength (Izod): on notched specimens: Panel thickness before notching	Impact strength (Izod): on notched specimens: Flatwise[3]	Impact strength (Izod): on notched specimens: Edgewise[4]	Impact strength (Izod): on unnotched specimens: Flatwise	Impact strength (Izod): on unnotched specimens: Edgewise
	In.			Per cent	Lb. per sq. in.	Lb. per sq. in.	1,000 lb. per sq. in.	Lb. per sq. in.	Lb. per sq. in.	1,000 lb. per sq. in.	Lb. per sq. in.	Lb. per sq. in.	1,000 lb. per sq. in.	Per cent	Per cent	Per cent	Per cent	In. lb. per In. width	M scale	Lb. per sq. in.	Lb. per sq. in.	Lb. per sq. in.		Inch	Ft. lb. per in. of notch		Ft. lb. per in. of width	
Section 1—Parallel laminated—tested parallel to fiber direction (grain)																												
2239-A	0.125	1.39	75°F.–50% R.H.	7.7	28,520	7,160	2,513	13,680	3,770	2,320	27,130	9,000	2,306	5.2	0.00	0.40	4.12	46.0	76.2	11,200	.....	[5]13,445	2239-D	0.489	12.62	1.82		
2239-Q	.130	.....	Heated at 158°F.		20,080	5,250	2,617																					
2239-Q	.129	.....	Heated at 200°F.		19,477	6,440	2,633																2239-D	.489	10.47	1.87		
2239-D	.489	.....	Cooled at −68°F.	7.4																	10,700		2239-D	.489	9.76	1.41		
2238-K	.122	1.38	75°F.–50% R.H.	7.5	24,500	5,940	2,317	12,610	3,447	2,147	25,470	9,640	1,909	5.5	.....	.....	.....	49.2										
2238-I	.125	.....	75°F.–50% R.H.		25,600	7,430	2,067																					
2238-I	.125	.....	Packed in dry ice		27,100	8,500	2,894																					
[6]2237-G	.499	.....	75°F.–50% R.H.	5.9																		14,427	2237-G	.499	.....	1.63	16.40	11.50
[6]2237-G	.500	.....	Heated at 200°F.	5.9																			2237-G	.500	.....	1.81		
Section 2—Parallel laminated—tested perpendicular to fiber direction (grain)																												
2239-E	.129	1.40	75°F.–50% R.H.	7.1	8,730	2,090	927	11,620	1,630	963	12,240	4,280	950	5.3	.16	.15	4.32	44.2	77.6	.....	.....	.....	2239-D	.494	13.10	1.65		
2239-Q	.134	.....	Heated at 158°F.		6,455	2,400	980																[7]2239-D	.488	11.52	1.51		
2239-D	.486	.....	Cooled at −68°F.	7.4																	13,850		2239-D	.486	8.20	.99		
2238-L	.119	1.37	75°F.–50% R.H.	7.5	8,560	2,960	918	11,250	2,280	818	11,960	5,030	869	.....	.....	.....	.....	45.5										
2238-I	.125	.....	Packed in dry ice		10,020	3,630	1,102																					
[6]2237-G	.503	.....	75°F.–50% R.H.	5.9																			2237-G	.503	12.80	1.56		10.04
[6]223W-G	.506	.....	Cooled at −68°F.	5.9																			2237-G	.506	2.97	.85		
Section 3—Cross laminated																												
2239-F	.126	1.39	75°F.–50% R.H.	7.5	10,770	4,050	1,793	13,110	2,460	1,694	20,000	5,720	1,673	5.3	.00	.20	4.43	31.8	88.2	11,530	.....	13,845	2239-P	.490	8.51	1.59		
2239-G	.106	.....	Heated at 158°F.		14,770	4,260	1,772																					
2239-F	.490	.....	Heated at 200°F.	7.1																			2239-P	.490	6.87	1.05		
2239-F	.492	.....	Cooled at −68°F.	7.1																			2239-P	.492	6.34	.98		
2238-J	.120	1.39	75°F.–50% R.H.	7.5	15,190	4,080	1,658	9,830	2,295	1,340	19,335	6,100	1,353	5.7	.....	.....	.....	20.6										

[1]Run 37—Forest Products Laboratory experimental black spruce sulphate pulp, cooks 2644 and 2645 combined. Content of added lignin—43.2 percent. Lignin-filled pulp from run 2239 was jordaned, whereas runs 2237 and 2238 were not jordaned. Laminating and testing conditions: Temperature, 356°F.; pressure, 500 pounds per square inch; time, 10 minutes for ¼-inch thickness, 20 minutes for ½-inch thickness; panels cooled before release of pressure. The preparation, conditioning, and testing of specimens conforms to the Federal Specification for Plastics, Organic; General Specifications (Methods of Tests (L-P-406, Dec. 9, 1942. [2]Thickness of laminated plastic (in molding pressure direction). [3]Load applied to the flatside of the original material (parallel to the direction of molding pressure). [4]Load applied to the edge of the original material (perpendicular to the direction of molding pressure). [5]Specimens from panel 2239-E. [6]Lignin-filled paper coated with additional lignin on paper machine, thus increasing lignin content to 45.0 percent. [7]Specimens conditioned at 200° F

Table 3.—Simplified[1] summary of data on lignin-filled laminated-paper plastics, parallel laminated, all tests made in direction of grain.

Pulp	Lignin added	Laminating pressure	Specific gravity	Tensile strength: Ultimate	Tensile strength: Modulus of elasticity	Edge compressive strength: Maximum	Edge compressive strength: Modulus of elasticity	Flexural strength: Modulus of rupture	Flexural strength: Modulus of elasticity	Water absorption—24 hours: Weight increase	Dimensional change: Length	Dimensional change: Width	Dimensional change: Thickness	Forest Products Laboratory toughness	Izod impact: Flatwise	Izod impact: Edgewise	Rockwell hardness	Shear (Johnson): Flatwise	Shear (Johnson): Edgewise	Bearing strength (3/4 in. diameter pin) at 4% deformation of hole diameter
	Percent	Lb. per sq. in.		Lb. per sq. in.	1,000 lb. per sq. in.	Lb. per sq. in.	1,000 lb. per sq. in.	Lb. per sq. in.	1,000 lb. per sq. in.	Percent	Percent	Percent	Percent	In. lb. per in. width	In. lb. per in. notch	In. lb. per in. notch	M scale	Lb. per sq. in.	Lb. per sq. in.	Lb. per sq. in.
Commercial bleachable A[2]	34.8	750	1.40	24,600	2,300	13,000	2,300	28,000	2,300	5.9	0.00	0.50	4.91	36	9.8	1.4	92	.....	.....	[3]2
Commercial bleachable A[2]	34.8	1,500	1.43	22,000	2,250	15,000	1,800	27,000	2,100	6.6	.....	.....	.....	38	.....	.....	.....	.....	.....	.....
Commercial bleachable A[2]	37.9	1,500	1.43	20,000	2,400	16,000	2,100	28,000	2,100	4.5	.....	.....	.....	31	.....	.....	.....	.....	.....	.....
Commercial bleachable A[2]	43.6	500	1.36	18,000	2,000	14,000	1,800	23,000	1,800	5.7	.....	.....	.....	31	.....	.....	.....	.....	.....	.....
Commercial bleachable A[2]	43.6	750	1.40	20,000	1,900	13,000	1,900	24,000	1,900	5.3	.....	.....	.....	30	.....	.....	.....	.....	.....	.....
Commercial bleachable A[2]	47.0	500	1.38	18,000	2,000	13,000	1,800	22,000	1,700	5.0	.00	.35	3.11	29	6.1	1.2	.....	10	.....	.....
Commercial bleachable A[2]	47.0	750	1.39	19,000	1,900	12,000	1,900	23,000	1,900	4.6	.....	.....	.....	30	.....	.....	.....	.....	.....	.....
Commercial bleachable B[2]	37.0	750	1.41	24,000	2,400	13,000	2,700	24,000	2,200	5.5	.00	.40	3.27	41	[4]10.4	[4]1.3	92	.....	.....	15
Commercial bleachable B[2]	37.0	1,000	1.43	23,000	2,500	14,000	2,200	25,000	2,100	5.0	.....	.....	.....	39	.....	.....	.....	.....	.....	.....
Experimental laminating, U. S. Forest Products Laboratory	43.2	500	1.39	20,000	2,500	14,000	2,300	27,000	2,300	5.2	.00	.40	4.12	46	12.8	1.8	78	11	11	13
Experimental laminating, U. S. Forest Products Laboratory	43.2	1,000	1.41	28,000	2,700	13,000	2,400	27,000	2,400	4.8	.....	.....	.....	45	.....	.....	.....	.....	.....	.....

[1]For complete data, see table 2. [2]Commercial bleachable sulfate pulp obtained from a Wisconsin mill. [3]Commercial bleachable sulfate pulp obtained from a Quebec mill. [4]Izod values taken from panel 2239-J, 38.6 percent lignin (no similar data available on 2239-C, 37.0 percent lignin).

Influence of Process Variables on the Physical Properties of the Paper Laminate

In order to establish, and where possible enhance, the physical properties that may be obtained in a lignin-filled laminate, six process variables were studied:

(1) Lignin filler content; (2) type of sulphate pulp used; (3) use of lignin as a surface coating on the lignin-filled paper; (4) orientation of paper in lamination; (5) laminating pressure; and (6) the use of special surface sheets to improve the resistance of lignin-filled laminates to water absorption.

The physical properties of a laminate pressed at 500 pounds per square inch and 356 Fahr. using a moldable paper in which 43.6 per cent added lignin had been incorporated with an experimentally produced suphate pulp are given in Table 1.[3] These data illustrate, in a specific example, the physical properties that have been studied, and the values obtained. Data for materials covering a wide range of process variables, indicating the effect of these variables on the various physical properties are given in Table 2. This table is arranged in three sections:

(1) Panels parallel laminated, tested parallel to fiber direction; (2) panels parallel laminated, tester perpendicular to fiber direction; and (3) panels cross laminated.

Each section is further divided into three goups, one for each of the pulps used:

(1) Commercial bleachable sulphate pulp A obtained from a Wisconsin mill; (2) commercial bleachable sulphate pulp B obtained from a Quebec mill (Howard Smith Paper Mills, Ltd.); and (3) experimental high-strength laminating sulphate pulp made by U. S. Forest Products Laboratory (Dig. 2644 and 2645). In each of these groups the data are arranged in order of increasing lignin content of the laminate.

The principal data from Section 1 of Table 2 has been rearranged in simplified form in Table 3 to allow a more ready evaluation.

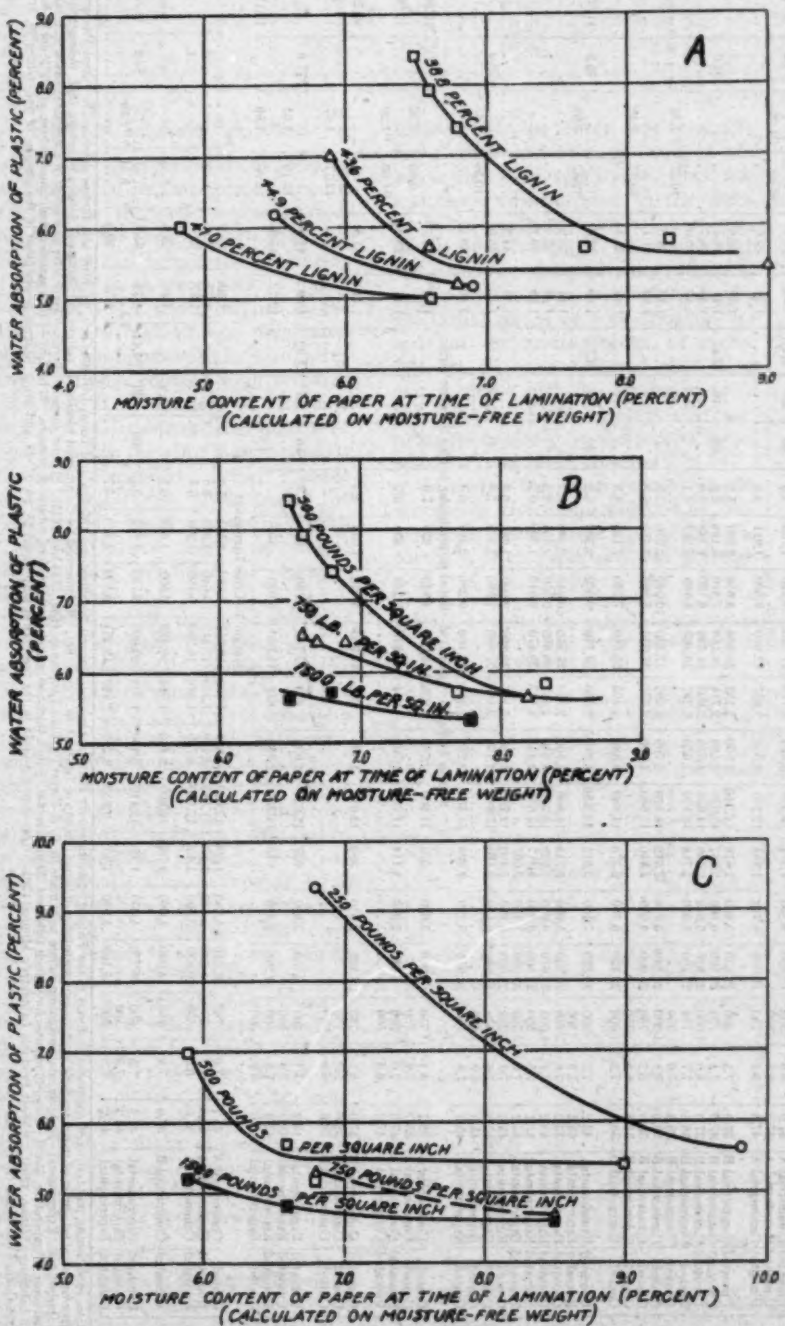

A
38.8 PERCENT LIGNIN
43.6 PERCENT LIGNIN
34.9 PERCENT LIGNIN
34.0 PERCENT LIGNIN
WATER ABSORPTION OF PLASTIC (PERCENT)
MOISTURE CONTENT OF PAPER AT TIME OF LAMINATION (PERCENT)
(CALCULATED ON MOISTURE-FREE WEIGHT)
B
500 POUNDS PER SQUARE INCH
750 LB. PER SQ. IN.
1500 LB. PER SQ. IN.
WATER ABSORPTION OF PLASTIC (PERCENT)
MOISTURE CONTENT OF PAPER AT TIME OF LAMINATION (PERCENT)
(CALCULATED ON MOISTURE-FREE WEIGHT)
C
250 POUNDS PER SQUARE INCH
500 POUNDS PER SQUARE INCH
1000 POUNDS PER SQUARE INCH
750 POUNDS PER SQUARE INCH
WATER ABSORPTION OF PLASTIC (PERCENT)
MOISTURE CONTENT OF PAPER AT TIME OF LAMINATION (PERCENT)
(CALCULATED ON MOISTURE-FREE WEIGHT)

Fig. 1—Relation between moisture content of lignin-filled paper at time of lamination and water absorption of the laminated plastic. Laminating temperature 356 Fahr. (A) Effect of lignin content, laminating pressure 500 pounds psi. (B) Effect of laminating pressure, lignin content 38.8 per cent. (C) Effect of laminating pressure, lignin content 43.6 per cent

Effect of Lignin Filler Content

Data covering a considerable range of lignin filler content is available only for pulp A. In general with increasing lignin content, the physical strength properties become somewhat poorer (Table 3). In the range covered, 34.0 to 47.0 per cent lignin content, the tensile strength of the plastic decreased with increase in lignin content from 24,000 to 19,000 pounds per square inch, the edge compressive strength from 16,000 to 12,000 pounds per square inch, the flexural strength (modulus of rupture) from 28,000 to 22,000 pounds per square inch, and the Forest Products Laboratory toughness value from 38 to 29 inch pounds per inch width. The modulus of elasticity in tension decreased from 2,400,000 to 1,900,000 pounds per square inch and the moduli in compression and flexure showed a similar trend. However, with increasing lignin content, the pressure required for satisfactory lamination decreased, and in general, the resistance to water absorption improved.

(3) All tests on laminated plastics reported herein, if made at this Laboratory, were in accordance with Federal Specification for Plastics, Organic: General Specifications (Methods of Tests) L-P-406, Dec. 9, 1942.

Table 2.—Physical properties of lignin-filled laminated-paper plastics[1].

Panel number	Run number	Coated or uncoated[2]	Type of sulphate pulp[3]	Lignin content[4]	Moisture content of paper at time of lamination (moisture free basis)	Laminating pressure[5]	Tension			Edge Compression			Flexure			Water absorption, 24 hour[6]				Specific gravity	Forest Products Laboratory toughness[7]	Izod impact		Rockwell hardness 10+100kg.	Shear (Johnson)		Forest Products Laboratory plate shear[8]	Bearing ½-inch pin	Test panel thickness
							Ultimate	Proportional limit	Modulus of elasticity	Maximum	Proportional limit	Modulus of elasticity	Modulus of rupture	Proportional limit	Modulus of elasticity	Wgt. increase	Dimensional change						Flatwise	Edgewise		Flatwise	Edgewise	Modulus of rigidity	4 percent of ½-inch deformation	
																	Lgth.	Width	Thickness											
				Per cent	Per Cent	Lb. per sq. in.	Lb. per sq. in.	Lb. per sq. in.	1,000 lb. per sq. in.	Lb. per sq. in.	Lb. per sq. in.	1,000 lb. per sq. in.	Lb. per sq. in.	Lb. per sq. in.	1,000 lb. per sq. in.	Per cent	Per cent	Per cent	Per cent		In. lb. per in. width	Ft. lb. per in. notch	Ft. lb. per in. notch	M scale	Lb. per sq. in.	Lb. per sq. in.	1,000 lb. per sq. in.	Lb. per sq. in.	Inch
Section 1—Parallel laminated—tested parallel to fiber direction (grain)																													
2176-C	[9]35b	Uncoated	Commercial A	34.1	7.2	1,500	22,350	8,720	2,110	14,980	4,640	2,206	27,280	10,390	2,310	5.8				1.43	37.6									0.125
2221-D	[10]32	Coated	Commercial A	35.7	7.3	750	24,130	6,320	2,341	12,560	3,760	2,340	25,640	7,350	2,322	5.9	0.00	0.50	4.91	1.40	36.2			92.0				12,100	.113
2221-F	[10]32	Coated	Commercial A	35.7	7.3	750																9.78	1.38						.445
2221-E	[10]32	Coated	Commercial A	35.7	7.7	1,500	22,000	6,300	2,406	14,570	3,040	1,794	25,740	8,920	2,094	6.6				1.42	38.3								.113
2175-C	[9]25	Uncoated	Commercial A	37.9	6.6	1,500	19,890	6,820	2,360	15,920	4,000	2,148	28,480	11,020	2,078	4.5				1.43	31.0								.134
2194-E	[9]28	Uncoated	Commercial A	43.6	6.7	500	18,280	5,860	1,990	13,800	3,410	1,848	22,930	8,460	1,750	5.7				1.36	31.0								.128
2194-D	[9]28	Uncoated	Commercial A	43.6	6.8	750	19,780	7,420	1,928	13,110	3,460	1,864	23,870	9,660	1,929	5.3				1.40	29.8								.120
2204-C	[9]29b	Uncoated	Commercial A	44.9	6.9	500	18,560	5,200	2,080	14,890	3,220	1,817	22,900	7,140	1,761	5.2				1.37	33.7								.128
2203-H	[10]29	Uncoated	Commercial A	47.0	6.4	250	17,320	5,820	1,678	10,450	3,670	1,634	20,260	7,950	1,736	5.6				1.30	25.6								.135
2203-A	[10]29	Uncoated	Commercial A	47.0	6.6	500	18,280	5,790	1,974	13,290	3,620	1,770	21,920	9,220	1,703	5.0	.00	.35	3.11	1.38	29.4			75.2	9,770				.129
2203-D	[10]29	Uncoated	Commercial A	47.0	6.3	500																[11]6.40	[11]1.20						.515
2203-E	[10]29	Uncoated	Commercial A	47.0	6.4	750	18,930	6,440	1,885	12,110	3,540	1,857	22,660	8,500	1,911	4.6				1.39	29.6								.128
2230-A	[10]35	Uncoated	Commercial B	37.0	7.5	500	22,620	5,860	2,478	11,940	2,860	2,133	23,660	8,650	2,061	5.9				1.39	36.6								.124
2230-C	[10]35	Uncoated	Commercial B	37.0	7.4	750	23,860	6,690	2,387	13,020	4,460	2,714	24,480	7,810	2,184	5.5	.00	.40	3.27	1.41	41.1			92.0				15,200	.130
2230-I	[10]25	Uncoated	Commercial B	37.0	8.0	1,000	22,820	5,610	2,530	14,050	3,320	2,203	24,590	8,180	2,148	5.0				1.43	38.7								.127
2229-C	[10]35	Coated	Commercial B	38.6	7.7	750	25,260	5,650	2,718	14,420	3,620	2,287	26,360	8,680	2,283	6.1				1.42	40.0								.131
2229-J	[10]25	Coated	Commercial B	38.6	7.0	750																10.37	1.32						.491
2229-H	[10]35	Coated	Commercial B	38.6	7.1	1,000	24,800	6,770	2,512	14,520	2,700	2,392	27,320	10,060	2,270	5.9				1.42	38.5								.119
2225-B	[10]36	Coated	Commercial B	38.8	6.7	750	25,090	4,950	2,840	13,660	4,000	2,371	27,030	8,260	2,334	6.4				1.40	41.1								.120
2226-M	[10]36	Coated	Commercial B	38.8	6.9	750																10.17	1.48						.503
2226-O	[10]36	Coated	Commercial B	38.8	7.2	1,000	22,430	6,240	2,376	14,480	3,080	2,195	25,540	7,220	2,155	4.8				1.42	39.4								.123
2239-A	[10]37	Uncoated	Experimental	43.2	7.7	500	28,520	7,160	2,513	13,680	3,770	2,320	27,130	9,000	2,306	5.2	.00	.40	4.12	1.39	46.0			76.2	11,290		13,445		.135
2239-D	[10]37	Uncoated	Experimental	43.2	7.4	500																12.82	1.82			10,790			.493
2239-B	[10]37	Uncoated	Experimental	43.2	7.8	750	28,230	5,900	2,744	14,260	3,760	2,324	27,740	10,340	2,366	5.3				1.41	46.2								.128
2239-C	[10]37	Uncoated	Experimental	43.2	7.7	1,000	27,610	6,940	2,629	13,240	3,640	2,412	26,890	9,550	2,354	4.8				1'41	45.4								.128
2238-K	[10]37	Uncoated	Experimental	43.2	7.5	500	24,500	5,940	2,317	12,610	3,447	2,147	25,470	9,640	1,909	5.5				1.38	49.2								.132
2238-I	[10]37	Uncoated	Experimental	43.2	7.5	500	25,600	7,430	2,067																				.125
2237-C	[10]37	Coated	Experimental	45.0	7.7	250	25,990	6,180	2,490	13,260	3,260	2,157	25,190	9,000	1,944	6.3				1.35	44.5								.129
2237-A	[10]37	Coated	Experimental	45.0	7.5	500	27,340	6,140	2,470	13,840	4,130	2,188	27,860	7,580	2,348	5.8	.00	.45	4.25	1.40	46.0			79.0			12,215		.130
2237-G	[10]37	Coated	Experimental	45.0	5.9	500																10.54	1.53				14,427		.499
2237-B	[10]37	Coated	Experimental	45.0	7.8	750	26,910	5,220	2,620	14,400	3,280	2,260	27,180	9,280	2,167	5.5				1.40	46.6								.126
Section 2—Parallel laminated—tested perpendicular to fiber direction (grain)																													
2221-G	[10]32	Coated	Commercial A	35.7	8.1	750	7,960	3,020	970	11,900	2,730	926	12,020	4,840	950	7.0				1.40	43.7				12,830		541		.116
2221-F	[10]32	Coated	Commercial A	35.7	7.2	750																9.65	1.52			14,990			.445
2209-J	[10]29	Uncoated	Commercial A	47.0	7.0	500	6,380	2,040	1,114	11,700	1,760	924	11,840	5,240	893	5.2				1.37	36.8				12,000				.136
2203-D	[10]29	Uncoated	Commercial A	47.0	6.3	500																[11]4.90	[11]1.20			12,135			.515
2230-H	[10]35	Uncoated	Commercial B	37.0	8.1	750	8,400	2,610	986	12,040	1,360	938	12,960	4,020	1,036	5.3				1.41	44.5				12,290		589		.124
2229-J	[10]25	Coated	Commercial B	38.6	7.0	750																8.86	1.30						.491
2226-M	[10]36	Coated	Commercial B	38.8	6.9	750																13.17	1.67						.503
2239-E	[10]37	Uncoated	Experimental	43.2	7.1	500	8,730	2,690	927	11,620	1,630	953	12,240	4,280	950	5.3	.16	.15	4.32	1.40	44.2			77.6					.129
2239-D	[10]37	Uncoated	Experimental	43.2	7.4	500																13.10	1.65			13,850			.463
2238-L	[10]37	Uncoated	Experimental	43.2	7.5	500	8,560	2,960	918	11,250	2,280	818	11,960	5,030	809					1.37	45.5								.119
2237-G	[10]37	Coated	Experimental	45.0	5.9	500																12.90	1.56		13,150	14,430			.499
Section 3—Cross Laminated																													
2221-H	[10]32	Coated	Commercial A	35.7	7.6	750	15,040	3,980	1,699	12,610	2,840	1,490	18,320	5,840	1,574	7.4				1.40	25.9						555		.115
2191-N	[9]28	Uncoated	Commercial A	43.6	7.7	500	11,580	3,450	1,478	11,580	2,140	1,310	17,310	5,640	1,332	6.5				1.37	22.8								.124
2203-M	[10]29	Uncoated	Commercial A	47.0	6.5	500	10,920	3,700	1,452	12,690	1,780	1,326	16,950	5,790	1,234	5.5				1.37	22.0								.127
2230-D	[10]35	Uncoated	Commercial B	37.0	7.8	750	15,030	4,040	1,760	12,300	2,440	1,624	19,430	6,500	1,650	6.1				1.40	25.4						543		.123
2239-F	[10]37	Uncoated	Experimental	43.2	7.5	500	16,770	4,050	1,793	13,110	2,460	1,694	20,000	5,720	1,673	5.3	.00	.20	4.42	1.39	31.8			88.2	11,530		13,845		.126
2239-P	[10]37	Uncoated	Experimental	43.2	7.5	500																8.51	1.59						.490
2238-J	[10]37	Uncoated	Experimental	43.2	7.5	500	15,190	4,080	1,658	9,830	2,295	1,340	19,335	6,100	1,353	5.7				1.39	20.6								.129

[1]The preparation, conditioning, and testing of specimens conforms to the Federal Specification for Plastics, Organic; General Specifications (Methods of Tests) L-P-406, Dec. 9, 1942, and further described in Forest Products Laboratory Mimeo. 1319 (Restricted) [2]Lignin-filled paper coated at size-press of paper machine with aqueous suspension of lignin (Pickup of lignin, 1 to 9 percent). [3]Commercial A—Commercial bleachable sulfate pulp obtained from a Wisconsin mill. Commercial B—Commercial bleachable sulfate pulp obtained from a Quebec mill. Experimental—Experimental laminating sulfate pulp made by U. S. Forest Products Laboratory (Dig. 2644 and 2645). [4]Lignin content—Lignin filler plus lignin coating (if applicable) based on total moisture-free weight of laminating paper. [5]Laminating conditions: Temperature, 356°F.; Time, 10 minutes for ½-inch thickness, 20 minutes for ½-inch thickness; panels cooled before release of pressure. [6]3 by 1 by ½-inch samples conditioned in oven at 122°F. for 24 hours prior to test. [7]Intermediate machine (Forest Products Laboratory Mimeo. 1308). [8]Forest Products Laboratory Mimeo. 1301. [9]Lignin precipitated in the presence of pulp (Runs 25, 26, 27, 28, and 30). [10]Lignin precipitated in the absence of pulp (Runs 29, 31 to 38, inclusive). [11]Test carried out at National Research Council of Canada (B. S. S. notch used).

Table 4.—Distribution of strength in laminated samples resulting from orientation of paper in lamination. (Values given indicate range obtained in samples tested).

Strength	Parallel laminated	Cross laminated	
	Tested across grain	Percent[1] of average values when tested with and across grain in parallel laminated samples	Percent[1] of value when tested with grain in parallel-laminated panel
	Percent[1] of values when tested with grain		
Tensile, Ultimate	31– 35	89– 94	59– 63
Tensile, Modulus of Elasticity	37– 56	95–105	72– 74
Edgewise Compression, Maximum	85– 95	101–104	95–100
Edgewise Compression, Modulus of Elasticity	35– 52	89–105	60– 75
Flexure, Modulus of Rupture	45– 54	97–104	71– 79
Flexure, Modulus of Elasticity	41– 52	92–103	68– 76
F. P. L. Toughness	96–125	59– 71	58– 75
Izod, Flatwise	77–130	65.7	66.4
Izod, Edgewise	91–113	91.6	87.4

[1]For absolute values, refer to table 2.

Effect of Sulphate Pulp Used

Most of the experiments were based on commercial sulphate pulps available at the time the project was started, and, except for the instance cited later, no attempt had been made to develop in the pulp such properties as might particularly suit them for use in the production of high-strength laminates. Although laminates with only a limited range of lignin content were prepared from pulp B, comparison of test data with that of laminates from pulp A of approximately the same lignin content indicates somewhat better tensile strength, toughness, and moduli of elasticity for pulp B accompanied with a slightly lower edge compressive strength and modulus of rupture (Tables 2 and 3).

To determine the degree of improvement which might be expected if a special high-strength type of sulphate pulp previously found suitable for the production of high-strength phenolic paper plastics is employed, an experiment was made using such a pulp prepared from black spruce at the Forest Products Laboratory. The improvement in strength properties obtained in the plastic laminate from this pulp was quite marked, when compared with those of the laminate from the commercial pulp A of similar lignin content (43.2 and 43.6 per cent lignin, respectively, Table 3). The laminate from the U. S. Forest Products Laboratory pulp gave values approximately 50 per cent higher for tensile strength and toughness, 15 per cent higher for modulus of rupture, 25 to 35 per cent higher for the moduli of elasticity, together with a slight improvement in resistance to water absorption. However, no significant difference was obtained in the edge compressive strength value.

Use of Surface Coating of Lignin on Paper

Examination of the laminating paper, while in process on the paper machine and in the finished sheet, suggested that the lignin-fiber ratio on the surfaces of the sheet was probably lower than the average ratio in the whole sheet. In appearance, there was a definite two-sidedness to the sheet, probably resulting from a loss of part of the lignin originally associated with the fibers on the wire side. This loss might have taken place either during the initial period of formation on the wire, at the suction boxes, or at the felt. It was also observed that there was a slight pick-up of lignin from the top side of the sheet at the press rolls, particularly at the second press, which was made of Stonite.

To enrich the lignin content on the surface of the lignin-filled sheet, experiments were made in which the partially dried paper was run through the paper machine size-press in which an aqueous suspension of purified lignin previously precipitated at 203 Fahr. (95 C.) was used for the coating mixture. The lignin, having a particle size in the general range of 5 to 10 microns, was made into a 15 to 20 per cent suspension and the *p*H (initially 4.8) was adjusted with lime to 6.1 for runs 35 and 36 (panel Nos. 2226 and 2229) and 7.12 for run 37 (panel No. 2237). The lignin pick-up under these conditions amounted to 1 to 9 per cent. The results obtained were inconclusive, however. Comparison of the data (Table 2, section 1) indicates that the laminates made from the coated paper from runs 35 and 36 are approximately 1,000 pounds per square inch higher in strength values than those made from the uncoated portion of run 35, whereas in run 37, with a portion of the paper coated and a portion uncoated, a reversed condition was observed for the tensile strength, although other strength properties were not generally affected. The reason for this discrepancy has not been established although it is possible that the *p*H of the coating mixture, or the lime added, might have played an important role. Inasmuch as the range of improvement in properties that might be obtained from this procedure is not great, it is believed that this

Table 5.—Relationship between moisture content of lignin-filled papers of various lignin contents and water absorption of the laminated plastic when molded at various pressures.[1]

Panel number	Moisture content of paper on moisture free basis	Laminating pressure	Water absorption 24 hours
	Percent	Lb. per sq. in.	Percent
38.8 Percent Lignin Content			
2236-E	6.5	500	8.4
K	6.6	500	7.9
A	6.8	500	7.4
D	7.7	500	5.7
H	8.3	500	5.8
F	6.6	750	6.5
B	6.7	750	6.4
L	6.9	750	6.4
I	8.2	750	5.6
C	6.5	1,500	5.6
G	6.8	1,500	5.7
J	7.8	1,500	5.3
43.6 Percent Lignin Content			
2194-H	6.8	250	[2]9.3
G	9.8	250	5.6
J	5.9	500	7.0
E	6.6	500	5.7
L	8.8	500	5.2
A	9.0	500	5.4
D	6.8	750	5.3
B	8.5	750	4.7
I	5.9	1,500	5.2
F	6.6	1,500	4.8
C	8.5	1,500	4.6
44.9 Percent Lignin Content			
2204-A	5.5	500	6.2
C	6.9	500	5.2
47.0 Percent Lignin Content			
2203-H	6.4	250	5.6
C	4.8	500	6.0
A	6.6	500	5.0

[1]Laminating conditions: Temperature, 356°F; time, 10 minutes, panels cooled before release of pressure. Panel nominal thickness one-eight inch. [2]Split.

problem could be further investigated in commercial production, where sustained operation allows a more satisfactory study of the process variables involved.

Orientation of Paper in Lamination

In the manufacture of laminating paper the fibers tend to assume a higher degree of orientation in one direction (machine direction) and the resultant sheet exhibits anisotropic strength properties. Thus in laying up the paper sheets for lamination, this anisotropic characteristic can be carried through into the final panel by "parallel lamination." Alternatively by "cross lamination" (crossing the direction of alternate sheets), a panel having balanced strength properties can be obtained.

The general relationship of the strength values obtained in parallel and cross laminates is shown in Table 4. With parallel-laminated samples, tested at room temperature, the most marked difference is shown in the tensile strength, wherein the crosswise tests average only about 33 per cent of the lengthwise tests. The comparison for modulus of rupture is 50 per cent, edge compressive strength 90 per cent, and the moduli of elasticity between 35 and 56 per cent. However, with toughness and Izod, the crosswise strength values may be somewhat higher than those in which the direction of test is lengthwise.

In cross laminated samples, the strength values in either direction are in the range of 90 to 105 per cent of the average values obtained from crosswise and lengthwise tests on parallel-laminated samples with the exception of Izod impact strength (flatwise) and the Forest Products Laboratory toughness, which are about 65 per cent. The reason for these losses in impact and toughness strengths in cross laminated material cannot be explained at present.

The relationship of strength tests in cross-laminated samples to the lengthwise test in parallel-laminated samples is also shown in Table 4.

Laminating Pressure

In general, the pressure required for satisfactory lamination decreases with increasing lignin and moisture contents when the laminating temperature is held constant. Figure 1 (data from Table 5) illustrates the relationship between moisture content of the lignin-filled paper at time of lamination and the water absorption of the laminated plastic when the laminating temperature is 356 Fahr. Figure 1, A, with laminating pressure constant (500 pounds per square inch), shows that the moisture content of the laminating paper becomes less critical at higher lignin content. The plastic containing 47 per cent lignin has a water absorption value of 6 per cent when a laminating paper containing 4.8 per cent moisture is used. To obtain a similar water absorption value with the plastic containing 38.8 per cent lignin, 7.6 per cent moisture in the paper is required. With a paper containing 38.8 per cent lignin and having an appreciably lower moisture content, the water absorption value of the plastic is considerably increased.

Figures 1, B and 1, C compare the effect of varying laminating pressures with papers of 38.8 and 43.6 per cent lignin content, respectively, using the same ordinates. From these curves it is evident that the moisture content of the laminating paper becomes less critical when higher laminating pressures are used.

If the laminating pressure is lower than is optimum for either the lignin content or the moisture content of the paper, the moisture absorption value of the plastic will not only be high, but the edge compressive strength will be low. (Table 2.) With increased pressure these properties improve, but when the pressure is still higher, certain of the strength properties, notably the tensile strength, decrease appreciably.

The approximate pressures required for laminating lignin-filled papers of various lignin contents are shown in Table 6.

Table 6.—Approximate pressure required for laminating lignin-filled papers of varying lignin content.[1]

Lignin content	Pressure required to give laminates having suitable balance of physical properties	Minimum pressure for lamination
Percent	Lb. per sq. in.	Lb. per sq. in.
35	1,000–1,500	750
40	750–1,000	500
45	500– 750	250

[1]Temperature 356°F. Moisture content of paper 6.5–7.5 percent on moisture free basis.

As examples of panels laminated in the lower pressure range, reference is made to panels 2203-H and 2237-C shown in Table 2. These panels containing 47 and 45 per cent lignin, respectively, were molded at 250 pounds per square inch. The strength values are 1,000 to 2,000 pounds per square inch lower than those obtained with the same material laminated at higher pressures. The water absorption values, 5.6 and 6.3 per cent, respectively, although higher than those obtained with panels of the same lignin content laminated at higher pressures, are within an acceptable range for many purposes. At the time the various machine-runs were made, it was assumed that a laminate containing 45 per cent lignin would be relatively brittle and low in strength propeties and that higher lignin contents would be in an unacceptable range. However, the results subsequently obtained, particularly on the laminates containing high-strength fiber, indicate exceptional toughness when compared with other laminated materials. It is assumed that even with considerably higher lignin content, a desirable product can be obtained. No doubt a product of this type could be laminated in a lower pressure range.

Use of Special Surface Sheets to Improve Resistance to Water Absorption of Lignin-filled Laminates

None of the lignin-filled laminates discussed so far have contained resin other than lignin. A study was made to establish the degree of improvement in resistance to water absorption that might be obtained through the use of phenolic resin applied to the surface sheets in the form of a varnish before lamination. The experiments also included a mixed lignin-phenolic varnish and a 100 per cent lignin varnish. The data obtained are shown in Table 7. Although the results are of a preliminary nature, a definite improvement in resistance to water absorption is indicated. The use of approximately 25 per cent phenolic resin on the surface sheet was sufficient to reduce the water absorption from 5.0 to 2.9 per cent. This quantity of phenolic resin is relatively small when based on the weight of the final laminate, being only 1.2 per cent on a ⅛-inch panel. The appearance and mar-resistance of the panel are also considerably enhanced by this procedure. Accelerated weathering tests on both normal and surface-sheeted laminates are in progress.

Comparison of Lignin-filled Paper Laminates with Other Laminated Materials

With the exception of edge compressive strength (14,000 to 15,000 pounds per square inch), the physical properties obtained appear to be equal or superior to the conventional-type paper-base laminates on the market. However, the strength properties so far obtained, with the exception of toughness and impact, are considerably lower than the papreg currently in development at the U. S. Forest Products Laboratory. As shown in Table 8, Izod impact values, both flatwise and edgewise, are from two to three times as great as those so far reported for papreg and many times greater than those for the conventional paper laminates. The Izod face impact values are considerably higher than those for fabric base laminates and compreg, and

Table 7.—Effect of special surface sheets on water absorption of lignin-filled laminates. (Lignin-filled laminating paper coated on one side with resin varnish of indicated composition. One ply, resin side out, placed on each surface of lay-up).[1]

Base sheets				Surface sheets					Laminates			
Panel No.	Run No.	Moisture content of paper on moisture-free basis	Lignin content on moisture-free basis	Paper No.	Lignin content before coating	Resin varnish: Lignin content of total solids	Resin varnish: Phenolic content of total solids	Resin pick-up on paper	Added total resin on panel	[2]Added phenolic resin on panel	Water absorption 24 hours	Decrease in water absorption due to surface sheet
		Percent	Percent		Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
2303-A	29	6.6	47.0								5.0	
2303-K	29	7.6	47.0	2303	47.0	0	[3]100	23.1	1.19	1.19	2.9	42
2303-Q	29	6.5	47.0	2195	41.6	33	[4]67	12.3	.50	.33	3.9	22
2238-A	37	7.6	43.2								6.4	
2238-F	37	7.5	43.2	2303	47.0	0	[3]100	22.5	1.24	1.24	3.6	44
2238-H	37	7.3	43.2	2195	41.6	33	[4]67	19.3	.89	.59	4.3	33
2238-E	37	7.2	43.2	2226	38.8	100		14.3	.70		5.5	14

[1]Laminating conditions: Pressure 500 lb. per sq. in.; temperature 356°F.; time, 10 minutes. Panels cooled before release of pressure. . . Panel thickness: one-eighth inch nominal. [2]Spirit soluble resin BV-13850. [3]Water soluble resin BR-3995.

about equal to those for heat-stabilized wood and parallel-laminated birch plywood which has the advantage of lower specific gravity. Parallel-laminated wood has a high edge impact value with the grain but low across the grain. Glass-fiber base phenolic laminates appear to have impact values considerably higher than any reported on the material under discussion.

The changes in tensile and Izod impact strengths of the lignin-filled paper laminate were determined for both low and high temperatures. At low temperatures the samples were first conditioned for 24 hours at —68 Fahr. and then were packed in dry ice (—110 Fahr.). The tensile specimens were packed for 8 hours and the Izod specimens were packed for 30 minutes to one hour. The tensile specimens were repacked in dry ice for test, the machine grips being cooled in an outer chamber maintained at —20 Fahr. to —60 Fahr. The impact tests were made on a machine in the open atmosphere, within 20 to 30 seconds after taking the specimens from the cold box. For tests at high temperatures the samples were placed in an oven at the desired temperature for 24 hours prior to testing, then tested on a machine at room temperature.

The results of these tests are shown in Table 1. A parallel-laminated sample (2239-A) having a tensile strength of 28,520 pounds per square inch tested flatwise with the grain, at room temperature, was found to have a tensile strength of 19,480 pounds per square inch at 200 Fahr. (2239-Q), a loss of 31.6 per cent. Comparing the same material (2239-E) tested across the grain at room temperature and at 158 Fahr. (2239-Q), a decrease of 26 per cent in tensile strength was obtained. A cross-laminated sample of the same material (2239-F) dropped in tensile strength from 16,770 pounds per square inch at room temperature to 14,770 pounds per square inch at 158 Fahr. (2239-G), a loss of 12 per cent. A cross-laminated sample of papreg tested over the same range of temperatures was found to drop 26 per cent in tensile strength between room temperature and 158 Fahr. and 38 per cent between room temperature and 200 Fahr. In spite of the fact that lignin is a thermoplastic material, the loss in tensile strength at high temperatures is slightly less than that with the thermosetting phenolic.

When another sample (2238-I) of the lignin-filled plastic was tested at room and subzero temperatures (approximately —100 Fahr.) an increase in tensile strength from 25,600 to 27,100 pounds per square inch or 5.9 per cent was obtained.

In general, the Izod impact strength values made on the lignin-filled paper laminates at high and low temperatures were somewhat lower than those made at room temperature (Table 1), a characteristic of phenolic laminates as well. For example, a parallel-laminated panel having an Izod impact strength value of 12.82 foot-pounds per inch of notch when tested with the grain at room temperature gave a value of 10.47 foot-pounds at 200 Fahr., a loss of 18.3 per cent, and 9.76 foot-pounds at —68 Fahr., a loss of 23.9 per cent. In spite of these strength losses with change in temperature, the values obtained both at high and low temperature are still much higher than those obtained from papreg and conventional laminates tested under the most favorable conditions (room temperature).

Exploratory gluing tests using cold-setting urea high- and low-temperature phenolic-resin glues have indicated that good bonds can be obtained, with failures occurring almost entirely in the lignin-filled paper plastic rather than in the glue line, when the surfaces to be glued are lightly sanded.

In any application requiring large quantities of material having strength properties in the range of conventional plastics, and where high impact strength is of special importance, the lignin-filled paper-base laminates appear to offer excellent possibilities.

Table 8.—Notched Izod impact values of laminated materials.

Material	Specific gravity	Izod impact: With grain, Flatwise	With grain, Edgewise	Across grain, Flatwise	Across grain, Edgewise
		Ft. lb. per in. notch	Ft. lb. per in. notch	Ft. lb. per in. notch	Ft. lb. per in. notch
Glass-fiber-base Phenolic Laminates					
Panelyte PC 5576[1]	1.99	25.2	18.6	21.5	17.2
Parallel-laminated Wood Base Materials					
Birch[2]		11.8	10.9		
Birch plywood[2]	.77	13.9			
Heat stabilized wood[2]	1.35	13.0			
High impact compreg[2]	1.35	6.6			
Low impact compreg[2]	1.23	2.7			
Fabric-base Phenolic Laminates					
Grade L, light weight fabric base[4]	1.34	3.8–4.8	2.22	3.6–4.0	1.5
Grade C, heavy weight fabric base[4]	1.34	2.7–3.2	1.4–1.5	2.5–2.8	1.8–2.0
Paper-base Phenolic Laminates					
Papreg[2]	1.40	4.0–6.0	0.7–0.8	1.6–1.8	0.5–0.6
Grade XX[2]	1.34	1.7–1.9	0.6	1.9–2.1	0.6
Paper-base Lignin-filled Laminates					
43.2 percent lignin, experimental sulfate pulp	1.40	13.8	1.8	13.3	1.7
38.8 percent lignin, commercial sulfate pulp	1.40	10.2	1.5	13.3	1.7

[1]Barber, R. W., Mechanical Engineering, page 88, December 1942. [2]Stamm, A. J., Seborg, R. M., Millett, M. A., U. S. Forest Products Laboratory Restricted Mimeo No., 1386 (May 1943). [3]Unpublished data from the U. S. Forest Products Laboratory (Restricted). [4]Oberg, T. P., Schwartz, R. T., Shinn, D.A., Modern Plastics, 20, No. 8, 87, April 1943. [5]Erickson, E. C. O., Beller, K. H., U. S. Forest Products Laboratory Restricted Mimeo. No. 1319 (March 1943) page 5.

Electrical Drive For Corrugators

J. L. VAN NORT, Paper Mill Application Engineer
Reliance Electric & Engineering Co.

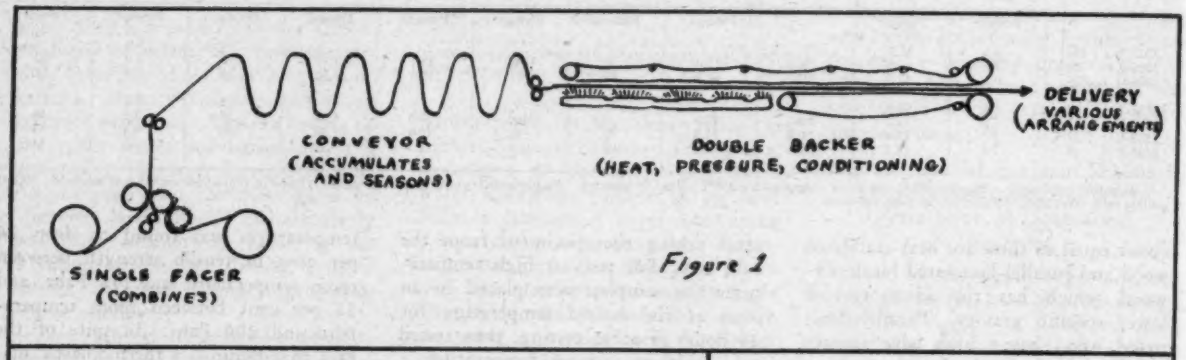


Figure 1

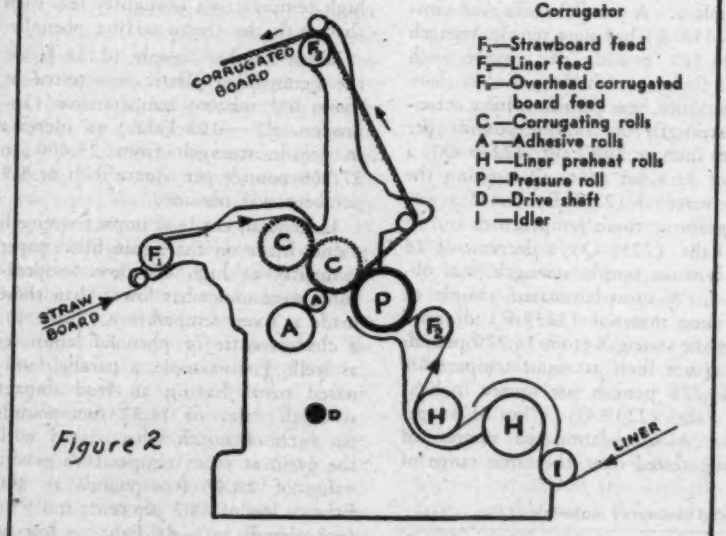


Figure 2

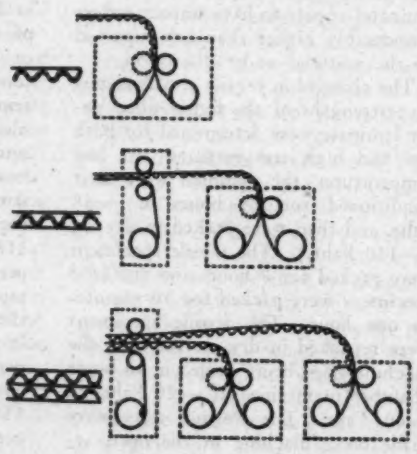


Figure 3

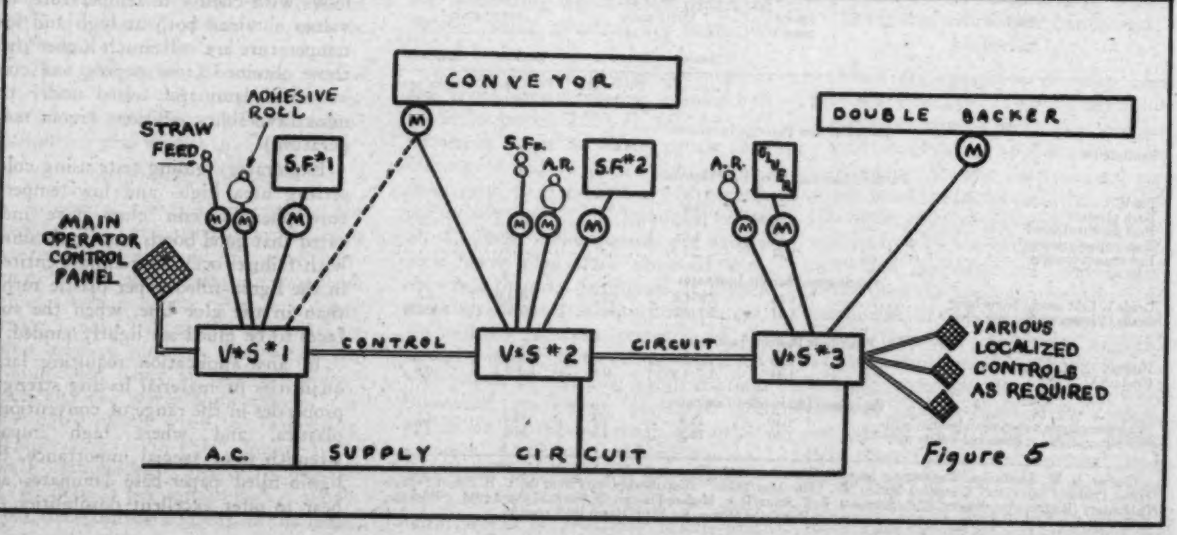


Figure 5

▶▶▶ THE OPERATION OF the modern high-speed corrugating machine provides an unusual opportunity for the application of integrated electrical drive.

The corrugator, in common with most of today's high production process machinery, is complex in function, and represents a considerable investment. If the equipment is to be operated profitably there must be maximum output with sustained high quality of product. This means, among other things, that the power equipment driving the machine must be tailored to the process, with precise, speedy operator control over all functions.

The simplest version of a corrugator line is shown schematically in Figure 1. Processing begins as the corrugating unit proper—shown in greater detail in Figure 2—draws strawboard and kraft liner from mill rolls, impresses corrugations on the strawboard, applies adhesive to the tips of the corrugations by means of adhesive rolls, and combines the corrugated board with the liner which has been preheated. The combined board then travels through an overhead bridge accumulator to season and lose moisture, and is combined in the double backer by compression between belts in the heating section, where it cures, and in the conditioning or pulling section. Final sections are slitting and scoring, and rewinding or cutoff and delivery at the far end of the line.

The various types of board are illustrated in Figure 3. When liner is applied to one side of the corrugated board, the product is known as single face material; when both sides are faced it is double face board. When two single faced boards are combined with a third liner, double wall board is the result. Only two basic fabricating machines are involved: single facers combine single face board, while glue machines (installed as a section of the double-backing unit) apply liner alone. Various arrangements and combinations of these two fabricating machines with suitable conditioning and finishing sections are possible to produce various kinds of board. The most complex, a double wall machine —consisting of two single facers and a glue machine, with double backer— can also be run with only one or two of the fabricating machines in operation, to produce single face, double face, or two single face strips.

The power drive for such machines obviously must be quite versatile, and include many specialized operating features.

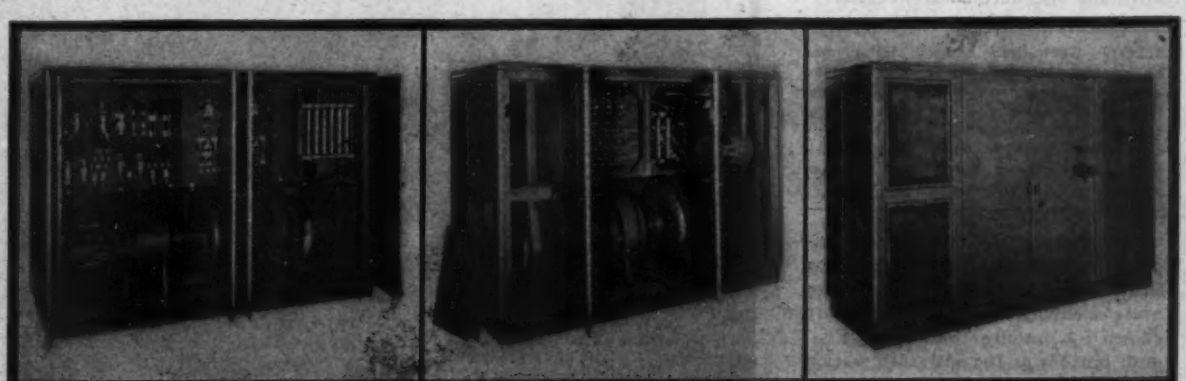
Since there are a number of units involved, all must run synchronously in whatever arrangement is chosen, and provision should be made for the operation of various combinations of equipment when different varieties of board are to be produced. Adjustable speed should be provided, with a range of line speeds available to include "slow motion" for threading all the way up to the highest production speed that the most favorable materials will support. At the same time, all elements will not be operated at the same speed as the material feed: adhesive roll operation is adjusted for various production runs for maximum gluing efficiency, at some variable ratio of line speed. The function of the bridge conveyor is to accumulate material for seasoning, and hence it must operate at only a fraction of line speed. Also required in the minimum drive would be quick braking for efficient operation, as well as instant operator control over all functions.

The pattern of these requirements, as well as further refinements possible to increase operating efficiency, fits neatly the specifications of a basic adjustable-speed drive developed by Reliance Electric & Engineering Company as a fundamental power drive which can be readily adapted to the individual operating requirements of machines where a wide range of speeds is required.

Based on a variable voltage system, where comparatively small excitation currents can easily be controlled to give a very sensitive adjustable-speed system, the Reliance V*S drive has been engineered with specialized circuits and integrated control to give many unusual operating possibilities. Stepless speed setting in a 20:1 range is easily possible, and a number of driving motors can be readily synchronized with each other in a single system. Acceleration and deceleration can be closely controlled. Multiple speeds in variable ratios are available, with pre-set operating points where these would be useful. Extremely low speeds and jogging are available for setting up operations, as is dynamic braking for quick stops.

Operating from a-c circuits, the V*S unit is a "packaged" system which is both economical and efficient. The equipment cost represented, in the average installation, is somewhat less than that required merely to install d-c plant circuits for ordinary d-c driving motors.

Figure 4 (below)



As a basic unit, it can be supplied with a relatively simple control panel for straightforward adjustable speed drive. More complicated functions mean merely the mounting of additional control panel circuits.

Introduced six years ago in a 1 to 30 hp. size range, the wide application of the V*S Drive in subsequent years has led to the extension of the range to 200 hp. Figure 4 illustrates the control unit of a drive of this rating. The cabinet, force-ventilated through filters and under positive internal pressure to exclude dirt and vapor, houses the variable voltage set with exciter and control panel, all easily accessible for inspection. The unit can be located at any distance from the motor or motors it supplies, as well as the operator's push button station or stations which control it.

Figure 5 shows a representative layout of a typical corrugator, with V*S power application. Here the fabricating range consists of two single facers with a glue machine and double facer which are capable of operating in combination to make double wall board. Three V*S units supply the entire machine with operating power, and are in turn served by alternating current plant circuits. A-c power, incidentally, is thus made available for accessories such as roll elevators and cutoff adjustments, and the control for these may be included within the V*S cabinet to make a single factory wired and assembled control center.

The first control unit handles the power which operates the principal elements of single facer #1. Operating speeds in an 8 to 1 range are chosen by pressing "Slow" or "Fast" push buttons at the operator's station. For setting up, a threading speed of

ABOVE—Note the compactness and simplicity of electrical drive. Overhead motor and single facer main drive motor are conveniently located, offering no obstruction to operator activity. Conduit is run in out-of-the-way location to control units which may be placed at any convenient location

CENTER—A conveyor speed-up station is shown at the entry to the double backer. In addition to the main control panel, duplicate controls for individual adjustments can be located at the spots where adjustment occurs

BELOW—Centralized control station may be located anywhere, but is often spotted at the first single facer of a line. Liner from the mill roll stand (on the left) is being combined with corrugated strawboard being drawn from the right; combined product is shown traveling on the bridge conveyor overhead

1/20th normal is available. A second and smaller motor drives the straw feed and provides torque which controls the rate of speed at which the paper is fed into the corrugating rolls, thus maintaining uniform tension, irrespective of the size of the roll or the condition of the paper which is being fed. The adhesive roll is driven by a separate motor, also, for improved operation. Fed by the same control unit, it is synchronized with the main corrugator feed at whatever speed relationship is chosen for the highest gluing efficiency. In addition, the adhesive motor is provided with a slow speed which cuts in automatically when the corrugator is temporarily shut down, so as to keep the silicate solution from hardening on the roll.

The second V*S unit operates in the same manner as the first, and in addition supplies the bridge conveyor with linear travel of a fraction of line operating speed, in order to accumulate the board for seasoning. A speedup of the conveyor on the overhead bridge of as much as two or three times normal speed is possible by operation of a high speed hold-down push button at the operator's station, so that when starting up, the material may be threaded into subsequent machines and production started at once.

If, however, the machine is to be operated as a single or double face machine, with the second corrugator not operating, the first V*S unit automatically assumes the job of operating the conveyor, so that the second unit can be shut down completely.

The third control unit supplies the adhesive roll and main drive of the gluing machine, the double backer and conditioning conveyors and the delivery mechanism. All three units are synchronized at whatever operating speed is selected, to produce a perfect product. The withdrawal of the second V*S from service when other than double wall board is being produced does not change the synchronous relationship of the other two machines.

As quick stopping is extremely advantageous should trouble develop in the process, this feature is provided—inherently—in the V*S setup by dynamic or regenerative braking of the drive motors.

Despite the apparent complexity of function of the V*S corrugator drive setup, its control is quite simple, and virtually effortless from the operator's point of view. In addition to duplex unit controls located at strategic adjustment points, a centralized control station brings together all controls for the entire machine. This station panel includes: start-stop and jog buttons; over-all speed control with slow-fast buttons; on-off for adhesive roll (used when shutting down only); on-off for straw feed; tachometer for line speed; high-speed hold-down button for clearing conveyor when starting up and when changing rolls; and ammeters so that the operator may "keep the pulse" of the individual electrical machines.

The delicate operations of starting up and slowing down, are removed as a source of trouble by the inclusion of automatic acceleration and deceleration in the control at pre-determined rates. This feature is effective at any operating speed, and acceleration stopped at any point will resume at the set rate upon subsequent operation of the "Fast" button.

Aside from process, the V*S drive satisfies other practical operating considerations a well. Maintenance, for example, as against mechanical systems with line shafts, clutches, etc.—or as against electrical arrangements with scattered, unintegrated equipment and control—is much simplified. The filter ventilated cabinet combines easy accessibility with safety and complete protection of equipment.

Flexibility of equipment, very important to the large processor, is unusual in that each fabricating element becomes, with integral drive, a unit that may be shifted from line to line with minimum interference to production. When, because of changes in operations, or in accordance with maintenance schedules, various fabricating units can be shifted elsewhere to advantage, the only electrical circuits to be rewired are those bringing distributing power from the control units. The more complicated control circuits remain undisturbed, exactly as installed before the initial delivery of the packaged unit from the factory.

Green Cross for Safety Campaign

▶▶▶ Americans will be called upon to rally behind the Green Cross for Safety this May, when the National Safety Council launches a nationwide fund-raising campaign aimed at winning general public support of its far-reaching accident prevention work.

The Green Cross will serve as the emblem and banner of safety—safety in the home, on the farm, in the factory, and on the teeming streets and highways of America.

The drive, marking the first time in its 33-year history that the National Safety Council has gone directly to the public for funds, comes at a time when the public is growing increasingly aware of the accident problem because of the appalling rise in traffic deaths since the end of the war.

In announcing the campaign, Ned H. Dearborn, president of the Council, emphasized the following points:

During the war, deaths and injuries from accidents on the home front exceeded battle casualties among the American forces. Our losses to enemy action were 261,608 killed, and 651,911 injured. Home front accidents of all types during this period claimed 355,000 lives and brought injuries to 36,000,000 persons, no less than 1,250,000 of these injuries being of a permanent nature.

There were 96,000 Americans killed last year in all types of accidents—equivalent to the annihilation of six full infantry divisions.

At least 10,300,000 persons were injured in all accidents in 1945 alone—a total approximating the peak war strength of the U. S. armed forces.

The fund drive is designed to promote two important goals, Mr. Dearborn said. By having the men, women and children of the country contribute funds, it will make them stockholders in an enterprise working for their own protection. It will make them active participants in a program they accepted only too passively before.

The Council thus expects to create such a strong concern for safety in the public at large and to broaden its financial support to such a degree that vigorous safety campaigns will be carried out on a scale impossible before, the Council head declared.

Mr. Dearborn pointed out that up to now the National Safety Council has existed with the financial backing of a small group of industrial concerns and individual contributors. Organized for public safety in 1913, the Council and its rapidly multiplying chapters have pressed their fight in all areas of human activity during decades which saw life become increasingly hazardous with the rapid expansion of mechanical processes. The Council has advanced programs which have been credited with saving at least 330,000 lives that might have been lost had the accident rate continued at the 1913 level.

The Green Cross for Safety encircled in a green band will serve as the official insigne of the drive. It will be reproduced in magazines and newspapers, on bill boards and car and window cards, and in motion pictures and still photographs. Mr. Dearborn said the National Safety Council hopes that by making the Green Cross a part of the American scene, the practice of safety may be established as a characteristic of the American way of life.

Zein — Its Use in Coatings

An Annotated Bibliography

T. T. COLLINS, JR.
Thilmany Pulp and Paper Company

AUTHOR'S NOTE: In preparing this bibliography, the author has purposely omitted a number of papers and patents which refer only to methods of preparation and purification of zein. The references given are those which are of interest for formulating lacquers, "hot-melt" or thermoplastic coatings, aqueous dispersions, thermosetting combinations, and films from zein.

1. Anon. New plant first to produce zein on commercial scale. ***Chem Industries*** **54, No. 5:670-1 (May, 1944):** ***B.I.P.C.*** **14:386 (1944).**

The replacement of shellac in lacquers and coatings with zein due to wartime shortages is mentioned. Its use in greaseproof, heat-sealing paper coatings is also reported. The new zein-extracting plant of the Corn Products Refining Company is described as well as the purification process employed.

2. Atlas Powder Company. Coating compositions. British patent 495,352 (Nov. 11, 1938); ***C.A.*** **33:3035 (1939);** ***B.C.P.A.*** **1939B:407.**

Compositions suitable as adhesives, greaseproof films or coatings, and paints are composed of water-soluble binders (zein among them) together with flexibilizers such as sorbitol, etc. Plasticizers, hardening agents, and mold inhibitors can be added.

3. Atlas Powder Company. Coated fabrics, paper, etc. British patent 501,558-9 (March 1, 1939); ***C.A.*** **33:6488 (1939);** ***B.C.P.A.*** **1939:712.**

Fibrous materials, such as paper, cloth, etc., are rendered grease-resistant by first coating with a cellulose derivative and then a water-soluble glue (made from zein) flexibilized with sugars or polyhydric alcohols and hardened by formaldehyde.

4. Baxter, E. L. (Eastman Kodak Co.) Roll film cartridge. U. S. patent 2,262,987 (Nov. 18, 1941) (Cl 95-9); ***C.A.*** **36:1252 (1942).**

Backing paper for roll film is coated with a zein solution because zein has been found to give as much protection from fog, mottle, and offset as gelatin, and as good protection from moisture as cellulose esters and resins. In addition, it is free from static effects and can be applied directly to the paper. This coating protects the light-sensitive layer on the film from contact with the printing and the surface of the backing strip. A finished mixture of zein (10-30% by weight), alcohol (85-95% by volume of solvent mixture), and water (5-15% of solvent) is used as the coating. In addition, other alcohols and solvents may be used.

5. Bennett, H., editor-in-chief, ***The Chemical Formulary,*** **Volume V. Chemical Publishing Company, Inc., Brooklyn, New York (1941).**

On page 485 are given several formulas for zein coatings. One consists of zein, lauric acid, and rosin, dammar, or manila gum dissolved in a mixture of alcohol and ethyl cellosolve. The other formulations include zein and urea with various solvents and plasticizers.

5A. Bennett, H., editor-in-chief, ***The Chemical Formulary,*** **Volume VII. Chemical Publishing Company, Inc., Brooklyn, New York (1945).**

On page 324 are given formulations for shellac substitutes composed of zein and rosin or an alcohol-soluble maleic resin.

6. Brother, G. H., and McKinney, L. L. Protein plastics from soybean products; action of hardening or tanning agents on protein material. ***Ind. Eng. Chem.*** **30:1236-1240 (Nov., 1938);** ***B.I.P.C.*** **9:167 (1938);** ***C.A.*** **33:266 (1939).**

Contrary to the statement in French patent 820,043 that zein reacts with formaldehyde more readily than casein, the authors found no hardening action on zein from either formaldehyde or furfural. Since zein has no free amino groups, it cannot give the reaction of free amino groups with formaldehyde. The water absorption of untreated zein was found to be less than that of the treated product.

7. Bull, H. B. Built-up films of protein and of sterol. ***J. Phys. Chem.*** **41:985-6 (1937);** ***C.A.*** **32:961 (1938).**

It is found that zein films are strongly hydrophylic, being completely wet by water. This contradicts the usual consideration that zein is one of the most hydrophobic proteins.

8. Chicago Paint and Varnish Production Club. A report by the Chicago Club on project No. 2. ***Official Digest Federation Paint and Varnish Production Clubs,*** **No. 215:208-9 (1942);** ***C.A.*** **36:4357 (1942);** ***Paint Varnish Production Mgr.*** **22:160-1 (1942), C.A. 36:5363 (1942).**

In making a zein paint to replace casein paint for camouflage purposes, a semi-paste is made from zein, water, and pigment. Ammonia is used to disperse the zein. This paint is stable for more than three weeks and is more waterproof than casein paint.

9. Close, J. W. (United Wall Paper Factories, Inc.). Adhesive and method of making. U.S. patent 2,284,800 (June 2, 1942) (Cl 106-153); ***C.A.*** **36:6704 (1942); Canadian patent 406,768 (Aug. 11, 1942);** ***C.A.*** **36:6271 (1942).**

An adhesive suitable for securing pigments upon wall paper is made by emulsifying corn-gluten meal in water by means of ammonium hydroxide and rosin. Since this gives a dark-colored adhesive, the mixture is bleached with hydrogen peroxide and other bleaching agents. The adhesive is made water-resistant by the use of aldehydes, metallic salts, and the application of heat.

10. Coleman, R. E. (The Zein Corporation of America). Zein solution and coating composition. U. S. patent 2,185,110 (Dec. 26, 1939) (Cl 134-12); ***C.A.*** **34:2967 (1940).**

A substantially nonaqueous liquid coating composition suitable for use both as coating and ink vehicle comprises zein and a substantially anhydrous solvent for the zein. The solvent has a proportion of polar to nonpolar radicals which lies within a range extending between the limits of the proportion of polar to nonpolar radicals of methyl alcohol and the proportion of polar to nonpolar radicals of ethyl alcohol; it contains not in excess of 5% added water; and the composition is stable and nongelling. Solvent mixtures of controlled or nongelling characteristics may be produced by mixing miscible compounds having a deficiency of hydroxyl or polar radicals with compounds having an excess thereof to secure the desired balance. If fillers and dyestuffs are added to the various solutions of zein mentioned, suitable printing inks may be prepared.

11. Coleman, R. E. (The Zein Corporation of America). Zein solution and coating composition. U. S. patents 2,185,111-7 (Dec. 26, 1939) (Cl 134-12); ***C.A.*** **34:2967 (1940).**

These patents cover the solvents and mixtures listed in Coleman's U. S. patent 2,185,110.

12. Coleman, R. E. (The Zein Corporation of America). Substantially nongelling zein coating composition. U. S. patent 2,185,118 (Dec. 26, 1939) (Cl 134-12); ***C.A.*** **34:2967 (1940).**

This patent covers some of the solvents and mixtures listed in 2,185,110.

13. Coleman, R. E. (The Zein Corporation of America). Substantially nongelling coating composition of zein in closed-chain alcohols. U. S. patent 2,185,119 (Dec. 26, 1939) (Cl 134-12); ***C.A.*** **34:2967 (1940).**

This patent is a division of 2,185,110.

14. Coleman, R. E. (The Zein Corporation of America). Substantially

nongelling coating composition of zein in diacetone alcohol. U. S. patent 2,185,120 (Dec. 26, 1939) (Cl 134-12); *C.A.* 34:2967 (1940).

Diacetone alcohol is the solvent listed in mixtures similar to those in 2,185,110.

15. Coleman, R. E. (The Zein Corporation of America). Heat hardening coating composition. U. S. patent 2,185,121 (Dec. 26, 1939) (Cl 260-6); *C.A.* 34:2967 (1940).

A thermosetting, baking type of varnish is made of zein and a water-insoluble, urea-aldehyde resin dissolved in a solvent such as ethanol, n-butanol, etc. The resin is polymerized in the alcohol solution and the zein is added to the solution along with other solvents. Diluents, plasticizers, dyes, pigments, and other materials may be added to form baking varnishes.

16. Coleman, R. E. (The Zein Corporation of America). Zein containing coating compositions. U. S. patent 2,185,122 (Dec. 26, 1939) (Cl 260-6); *C.A.* 34:2967 (1940.

This patent covers a similar material to that described in 2,185,121. The resin used is an alcohol-soluble polymer composed of reaction products of glycerol and phthalic anhydride or succinic acid. Ethylene glycol may be substituted for the glycerol in forming the resin.

17. Coleman, R. E. (The Zein Corporation of America). Process of producing stable zein solutions with auxiliary solvents. U. S. patent 2,185,123 (Dec. 26, 1939) (Cl 134-12); *C.A.* 34:2967 (1940).

Substantially nonaqueous solutions (water content not in excess of 5%) of zein in high concentrations are prepared with the aid of auxiliary solvents in small amounts. These are ethylene glycol monomethyl ether, dioxane, diethylene glycol, dichloroethyl ether, and linseed fatty acids. In addition, zein solutions of low concentration are made possible by the use of these auxiliary solvents.

18. Coleman, R. E. (The Zein Corporation of America). Coating composition. U. S. patent 2,185,124 (Dec. 26, 1939) (Cl 134-12); *C.A.* 34:2967 (1940).

This patent concerns zein solutions of increased stability in higher or lower concentrations than are ordinarily possible with substantially nonaqueous solutions of zein in 95% ethanol. The auxiliary solvents mentioned in 2,185,123 are listed together with the glycols, diacetone alcohol, benzyl and furfuryl alcohols, acetone, ethylene dichloride, diethylene glycol and ethyl acetate, cyclohexanol, ethyl lactate and tri-cresyl phosphate, amyl alcohol, ethyl methyl ketone and diethyl phthalate, toluol, etc., and various mixtures of these solvents.

19. Coleman, R. E. (The Zein Corporation of America). Method of coating printed surfaces and article formed thereby. U. S. patent 2,185,125 (Dec. 26, 1939) (Cl 91-67.9); *C.A.* 34:2967 (1940).

A varnish suitable for label or magazine cover coating is composed of stable solutions of zein. These coatings are somewhat water-resistant and also have some grease-resistance. Since the presence of more than 5% of water in the varnish tends to cause it to be somewhat unsuitable, other solvents besides aqueous ethanol are used, either alone or mixed. Propylene glycol, acetone-free diacetone alcohol, ethylene glycol monomethyl ether, and lauric acid. Resins, cellulose derivatives, and other materials may be incorporated to give added effects to the varnish.

20. Coleman, R. E. (The Zein Corporation of America). Coated article and method of forming the same. U. S. patent 2,185,126 (Dec. 26, 1939) (Cl 91-68); *C.A.* 34:2967 (1940).

Priming and sealing compounds are made from zein dissolved in substantially anhydrous ethanol mixed with auxiliary solvents such as diacetone alcohol, furfuryl alcohol, linseed fatty acids, etc.

21. Coleman, R. E. (The Zein Corporation of America). Stable zein solution. U. S. patent 2,188,895 (Feb. 6, 1940) (Cl 134-12); *C.A.* 34:3849 (1940)

Stable solutions of various concentrations of zein containing not in excess of 5% added water are prepared by using diethylene glycol, triethylene glycol, or propylene glycol as the solvent and then diluting the solution with ethanol, dioxane, dichloroethyl ether, or other auxiliary solvents.

22. Coleman, R. E. (The Zein Corporation of America). Ink. U. S. patent 2,236,521 (April 1, 1941) (Cl 134-35); *C.A.* 35:4620 (1941).

Zein solutions which are nongelling and are suitable for printing ink vehicles when combined with dyes and pigments are made of zein dissolved in 95% ethanol. The glycol ethers, the glycols, cyclohexanol, toluol, diacetone alcohol, etc., may also be used as auxiliary solvents. Rosin and linseed fatty acids are also used to give body to the ink. Cellulose nitrate and natural and synthetic resins and waxes may also be incorporated. Antigelling agents such as lactic acid or rosin acids and also wetting agents like sulphonated castor oil may be added. The addition of aluminum stearate and the resinates of zinc, aluminum, and calcium is mentioned.

Patent Index

United States

Patent	No.
456,772	67
456,773	68
924,057	43
929,660	34
965,137	44
1,245,975	74
1,245,976	75
1,245,977	76
1,245,978	77
1,245,979	78
1,245,980	79
1,245,981	80
1,245,982	81
1,245,983	82
1,245,984	83
1,280,861	84
1,280,862	85
1,316,854	70
1,320,508	106
1,333,321	60
1,365,607	107
1,966,604	113
1,992,122	45
2,047,961	46
2,070,596	47
2,074,332	48
2,102,623	49
2,115,240	90
2,115,716	50
2,115,717	51
2,134,769	109
2,143,023	65
2,156,927	91
2,156,929	103
2,158,481	52
2,178,924	92
2,185,110	10
2,185,111-7	11
2,185,118	12
2,185,119	13
2,185,120	14
2,185,121	15
2,185,122	16
2,185,123	17
2,185,124	18
2,185,125	19
2,185,126	20
2,188,895	21

United States (Cont'd)

Patent	No.
2,194,337	110
2,206,819	64
2,229,028	93
2,236,521	22
2,236,768	111
2,246,779	23
2,247,351	37
2,250,040	94
2,250,041	95
2,262,987	4
2,270,508	24
2,277,891	96
2,284,800	9
2,285,758	97
2,298,548	25
2,298,549	26
2,304,287	86
2,311,485	98
2,316,467	99
2,322,486	105
2,340,913	114
2,360,382	115

British

14,098 of 1907	43
9,313 of 1908	34
492,601	54
492,655	103
495,352	2
501,558-9	3
506,108	28
507,807	97
514,696	109
528,256	29
528,693	99
531,995	30
532,587	98
532,588	94
532,589	111
534,491	31
534,639	32
538,953	33

Canadian

Patent	No.
191,262	75
191,263	82

Canadian (Cont'd)

Patent	No.
191,264	79
191,265	83
191,266	80
191,425	84
191,426	76
191,427	77
191,428	78
365,209	49
366,922	52
392,462	109
400,632	97
406,395	86
406,768	9
418,287	66
419,396	73
419,463	116
419,687	100
420,292	87
420,800	101

French

388,097	34
Additions	
9,309	34
10,613	34
446,840	42
820,043	92
820,044	53
820,045	90
820,046	54
820,047	55
820,048	56
820,049	57
820,050	58
838,346	109
842,005	28

German

716,340	61
739,982	102

Japanese

28,307	74
29,247	75
32,293	82

23. Coleman, R. E. (Time Inc.). Prolamine containing compositions and solutions. U. S. patent 2,246,779 (June 24, 1941) (Cl 134-12); *C.A.* 35:6360 (1941).

This patent concerns a composition suitable for coating paper, cellophane, etc., containing not in excess of 5% added water and comprising zein in a solvent such as ethyl alcohol and an organic acid other than the lower aliphatic acids, such as succinic acid. This makes the solution substantially nongelling.

24. Coleman, R. E. (Time Inc.). Coating composition. U. S. patent 2,270,508 (Jan. 20, 1942) (Cl 106-153); *C.A.* 36:3359 (1942).

Substantially nonaqueous coatings containing zein may be made with low molecular weight alcohols like ethanol by the aid of stabilizing and opacifying agents which cause the zein film, on drying, to turn white. These opacifying agents are alcohol-soluble or -miscible liquids. The dry coating is said to be moisture- and oil-resistant and provides an excellent printing surface. The agents listed are dichloroethyl ether, glycerine, or cyclohexanol.

25. Coleman, R. E. (Time Inc.) Solution of zein in solvents acidified with inorganic acids. U. S. patent 2,298,548 (Oct. 13, 1942) (Cl 106-153); *C.A.* 37:1535 (1943).

Because of the difficulty in making solutions of zein in the lower molecular weight alcohols that do not gel or thicken on ageing, acid or acid-producing components may be dissolved in the substantially nonaqueous zein solution. Preferred are hydrochloric, boric, and phosphoric acids although nitric and sulphuric may be used. Inorganic acid salts; such as, aluminum chloride, etc., are also useful. A small amount of water may be added to the zein solution to bring about solution of the salts. The varnishes so prepared are said to be nonblushing Fatty acids, resins, cellulose derivatives, etc., may be incorporated to give other properties to the varnish.

26. Coleman, R. E. (Time Inc.). Treating zein. U. S. patent 2,298,549 (Oct. 13, 1942) (Cl 106-153); *C.A.* 37:1535 (1943).

This patent covers the materials listed in Coleman's U. S. 2,298,548 and in addition chloride salts are mentioned. A mixture of boric acid and aluminum chloride in the alcoholic solution of zein is said to make the solution stable against gelling and these solutions may be evaporated to dryness and the zein so treated sold for dissolving directly in alcohol.

27. Corn Products Sales Company. "Mazein." New York, N. Y. (1939).

This booklet gives considerable information with regards to Mazein (zein). An analysis of zein together with a list of suitable solvents, auxiliary solvents, and diluents for zein are given. Other topics discussed are plasticizers, modifying agents, the curing of zein films and coatings, and the use of zein in plastics, impregnating, and laminating. Also listed are coatings, aniline inks, adhesives, and water dispersions.

28. Corn Products Refining Company. Coated fabrics. British patent 506,108 (June 30, 1938); *C.A.* 33:9645 (1939); *B.C.P.A.* 1939B:969; French patent 842,005 (June 5, 1939); *C.A.* 34:4570 (1940).

Paper, cloth, or similar materials are rendered greaseproof by coating with a zein solution containing an oil- or grease-insoluble glycol, for example, diethylene glycol.

29. Corn Products Refining Company. Zein films. British patent 528,256 (Oct. 25, 1940); *C.A.* 35:7589 (1941); *B.C.P.A.* 1941B, III:18.

A thin layer of dry zein is treated with an aqueous solution of formaldehyde by which it is converted to a plastic, viscous, and flowable mass whereby a continuous film results. After this treatment, the zein may be brought in contact with a fibrous or absorbent material to make an impregnated paper which can then be subjected to heat and pressure.

30. Corn Products Refining Company. Compositions for impregnating paper or cloth. British patent 531,995. (Jan. 15, 1941); *C.A.* 36:658 (1942).

Zein is dissolved in alcohol and to it are added a phenolformaldehyde resin, an aromatic hydrocarbon solvent, and a plasticizer such as dibutyl tartrate, or di- or tri-ethylene glycol.

31. Corn Products Refining Company. Coating articles with zein-containing compound. British patent 534,491 (Sept. 8, 1939); *C. A.* 36:1415 (1942); *B.C.P.A.* 1941B, II :269.

A thermoplastic dispersion of zein in a zein-solvent resin, e.g., rosin, mastic gum, ester gum, synthetic resins of the glycol phthalate and urea resins types, is produced by melting the materials together. A similar compound may be produced by mixing a solution of rosin and zein and evaporating the solvent. The resultant compound is a solid at ordinary temperatures.

32. Corn Products Refining Company. Zein coating composition. British patent 534,639 (March 12, 1941); *C.A.* 36:1416 (1942); *B.C.P.A.* 1941B. II:202.

A coating composition for paper and other articles is composed of zein and rosin dissolved in a common solvent with less than 5% water present. Along with solvents; such as, methyl, ethyl, and diacetone alcohols, suitable plasticizers are also added.

33. Corn Products Refining Company. Impregnated paper. British patent 538,953 (August 22, 1941); *C.A.* 36:3670 (1942); *B.C.A.* 1941B, II :383.

A thermoplastic composition for impregnating paper and similar materials is prepared by mixing alkali-dissolved gluten with an alkali-catalized phenol-formaldehyde resin in the presence of an excess of formaldehyde.

34. Desvaux, L., and Allaire, H. Plastic product. U. S. patent 929,660 (Aug. 3, 1909); *J. Soc. Chem. Ind.* 28:1001 (1909); *C.A.* 3:2618 (1909); British patent 9,313 of 1908 (Apr. 29, 1908); *J. Soc. Chem. Ind.* 27:956 (1908); *C.A.* 3:725 (1909); French patent 388,097 (March 11, 1908); *J. Soc. Chem. Ind.* 27:873 (1908); Addns. to French patent 388,097 or 9,309 and 10,613; *J. Soc. Chem. Ind.* 27:1082 (1908).

This patent concerns a plastic product composed of nitrocellulose, camphor, and zein; all soluble in alcohol.

35. Dill, D. B. The behavior of the prolamines in mixed solvents. II. *J. Biol. Chem.* 72:239-247 (1927); *C.A.* 21:1996 (1927); *B.C.A.* 1927A :582; *Chem. Zentr.* 1927, II:93.

This investigator determined the critical peptization temperature of zein in a wide range of aqueous-alcoholic mixtures containing less than 95% alcohol by volume.

36. Donard E., and Labbe, H. Albuminoid substance from maize. Compt. rend. 135, (18): 744-6; *J. Soc. Chem. Ind.* 18:1464 (1902).

A protein is prepared from maize and the solubility in methyl or ethyl alcohols or acetone is discussed. It is better soluble in the warm solvent than in the cold and is precipitated by benzene, ether, or other hydrocarbons. It was found to be insoluble in weak acetic acid but weak aqueous or alcoholic solutions of alkali dissolve it. Higher alcohols are poor solvents for the protein.

37. Drewsen, P., and Little, J. R. (The Hinde & Dauch Paper Co.). Prolamine composition. U. S. patent 2,247,351 (July 1, 1941) (Cl 134-12); *C.A.* 35:6359 (1941); *Chem. Zentr.*, 1942, II:1529.

An aqueous solution of zein is made by dispersing the protein in a mixture of alkali and rosin in water. The zein can first be treated with ammonia and dissolved in alkali rosinate. This gives a water dispersible mixture.

38. Evans, C. D., and Manley, R. H. Solvents for zein-primary solvents. *Ind. Eng. Chem.* 33:1416-7 (1941); *B.I.P.C.* 12:132 (1941); *C.A.* 36:189 (1942); *B.C.P.A.* 1942B, III:51; *Chem. Zentr.* 1942, I:2467.

This study concerns anhydrous, primary organic solvents for zein which are found to be either hydroxy compounds, amines, amides, or acids. A method of measuring the critical peptization temperatures of zein in a number of solvents is given.

39. Evans, C. D., and Manley, R. H. Stabilizing zein dispersions against gelation. *Ind. Eng. Chem.* 35:230-2 (1943); *B.I.P.C.* 13:298 (1943); *C.A.* 37:2099 (1943); *B.C.P.A.* 1943B, II:223.

Observation had previously shown that the stability of zein solutions may be increased by storage at low temperatures, the use of substantially anhydrous solvents, by the addition of certain stabilizing reagents, or by keeping the zein concentration at a minimum. The present work shows that heating zein solutions of high concentrations in the presence of a small percentage of an aldehyde (formaldehyde, acetaldehyde) increases their stability toward gelation to a very marked degree. This treatment is suggested for solutions of zein in mixtures of water with ethanol, acetone, or dioxane. The resultant films from these mixtures are said to be highly resistant to swelling or "blushing" when soaked in water.

40. Evans, C. D., and Manley, R. H. Ternary solvents for zein. *Ind. Eng. Chem.* 36:408-410 (1944); *B.I.P.C.* 14:342 (1944); *C.A.* 38:3383 (1944).

It is pointed out that there is no sharp line of demarcation between primary, binary, and ternary solvents for zein. This study covers the ternary solvents which are suitable for use as gelation inhibitors in aqueous-alcoholic zein dispersions. The effects of rosin in aqueous-alcoholic solutions of zein in reducing the gelation tendency and also in lowering the critical peptization temperature of zein are noted.

41. Galeotti, G., and Giampalmo, G. Z. The Solubility of zein in Mixed Solvents. *Chem. Ind. Kolloide* 3:118-125; *C.A.* 3:856 (1909).

Zein is said to be soluble in 75% alcohol, insoluble in pure alcohol, water, xylene, petroleum ether, trichloromethane, and acetone; but when certain of these solvents are mixed, the zein is soluble in them. Solubility curves for zein in alcohol-water mixtures were prepared and also curves including one of the other solvents in the mixture.

42. Geistdorfer, J. J. Utilization of zein. French patent 446,840 (Aug. 2, 1912); *C.A.* **7:2356 (1913).**

Alcoholic solutions of zein may be used for impregnating or coating insulating papers and may itself be used as an insulator, when solidified.

43. Goldsmith, B. B. Thermoplastic compound and method of making same. U. S. patent 924,057 (June 8, 1909); *C.A.* **3:2200 (1909); British 14,098 (June 18, 1907);** *C.A.* **3:725 (1909).**

A thermoplastic composition is prepared by mixing beta-napthol with zein under pressure and heating. Other aromatic compounds may be substituted for the beta-napthol.

44. Goldsmith, B. B. Indurated albuminoid compound. U. S. patent 965,137 (July 19, 1910); *C.A.* **4:2745 (1910).**

A thermoplastic compound is prepared by mixing a converting agent and an indurating agent with corn gluten.

45. Hansen, D. W. (A. E. Staley Mfg. Co.). Coating material and process. U. S. patent 1,992,122 (Feb. 19, 1935) (Cl 91-68)); *C.A.* **29:2266 (1935).**

Zein to be used for applying to artificial leather is dissolved in a solvent composed of 45% by volume denatured alcohol, 35% acetone, and 10% water. It is also recommended to add 10% of a high boiling solvent such as butyl acetate. Dibutyl phthalate is added as a plasticizer. The natural oil in zein is also said to act as a plasticizer. This coating, when applied to pyroxylin-coated paper or cloth, makes the surface adhere to glues and cements that it is ordinarily repellant toward.

46. Hansen, D. W. (Prolamine Products, Inc.). Process of forming a prolamine-base flexible sheet material. U. S. patent 2,047,961 (July 21, 1936) (Cl 18-57).

A material suitable for films and coatings which has high water-resistant characteristics and is substantially moisture-proof is produced by reacting zein in an aqueous-alcoholic solution with formaldehyde in the presence of a plasticizer for the zein (glycerol) and then adding an alcohol-soluble phenol-formaldehyde resin. Hardening agents and plasticizers for the partially reacted resin are also incorporated.

47. Hansen, D. W. (Prolamine Products, Inc.). Manufacture of laminated films. U. S. patent 2,070,596 (Feb. 16, 1937) (Cl 18-57).

In order to facilitate stripping zein films from a casting surface and also to combine moistureproof films with those of zein, a film of zein in solvent is cast on a film of cellulose nitrate or cellulose acetate which has already been cast and dried on the casting surface. Another moistureproof film may then be cast on top of the zein film. The zein is in aqueous-alcoholic solution containing a leveling solvent (ethylene glycol monethyl ether), a plasticizer (dibutyl tartrate), an antiblushing agent (a salt of monethanolamine), and a protein fixative (formaldehyde or glyoxal)

48. Hansen, D. W. (Prolamine Products, Inc.). Transparent flexible film. U. S. patent 2,074,332 (Mar. 23, 1937) (Cl 18-57); *Chem. Zentr.* **1937, II:898.**

Combinations suitable for forming films and coatings are composed of zein, plasticizers (dibutyl tartrate, glucose), and a transparentizing agent (triethanolamine). The sheet is treated finally with a tanning agent (formaldehyde).

49. Hansen, D. W. (Prolamine Products, Inc.). Water-resistant prolamine base composition. U. S. patent 2,102,623 (Dec. 21, 1937) (Cl 106-38); *C.A.* **32:1364 (1938); Canadian patent 365,209 (April 6, 1937); Canadian patent 366,923-4 (June 22, 1937);** *C.A.* **31:5908 (1937).**

Plasticizing and preventing blushing of zein films are two major problems in connection with its use. Water in alcohol-water solutions of zein causes the film to turn white or "blush" on evaporation of the solvent due to precipitation of the zein in the presence of an excess of water. Leveling solvents, of higher boiling point than alcohol, are added to keep the zein in solution until all the solvent is evaporated. Some of these solvents give a smooth film and some give a rough film and in addition some solvents cause the film to strip readily from the surface on which they are cast and some cause difficulty in stripping. Solvents which give no cloudiness in the film are normal and iso-propyl alcohols, the butyl alcohols, various carbinols, the ethers of ethylene glycol, diacetone alcohol, and others. Leveling solvents which give slight cloudiness in the films after complete drying are some of the carbinols, heptyl alcohol, ethyl lactate, and diacetin. However, in the presence of the antiblushing agents, these solvents may work perfectly. For commercial purposes, leveling solvents which do not give an "orange peel" or rough surface are propyl or butyl alcohols or the ethers of ethylene glycol.

Plasticizers found to be suitable for use with zein have been divided into the following types:

1) Esters of hydroxylated organic acids —both aliphatic and aromatic acids are in this group. They are tartaric, citric, and salicylic acids. Alkyl and aralkyl esters of the hydroxylated acids are useful and among them are dibutyl tartrate, diisoamyl tartrate, tri-butyl citrate, etc.

2) Esters of fatty acids and polyhydric alcohols—Of the polyhydric alcohols glycerine, and the glycols are useful. The fatty acids suitable are the hydroxylated, saturated, and unsaturated fatty acids such as monoricinolein, ethylene glycol monolaurate, etc. These esters should be the monoesters, although some of the diesters are compatible with zein.

3) Sulphonamides—This type includes the aralkyl, aryl, and alkyl sulphonamides and their N-aryl and N-alkyl derivatives. The recommended material of an extensive list of these derivatives is toluenesulphonamide.

4) Esters of dihydric alcohol monoalkyl esters—The lactate or phthalate of ethylene glycol monoethyl ether are given as examples.

5) Amino acid esters—Both the aryl and alkyl esters may be used but the latter are preferred. These materials in the form of salts also act as "antiblushing" agents, and thus serve a dual purpose. Examples are the ethyl esters of glycine and alanine.

6) Derivatives of carbamic acid and substituted area—Ethyl and ethyl N-phenyl carbamate and also symmetrical diethyl-diphenyl-urea are suggested.

7) Glyceryl monoethers — the monoalkyl, monoaryl, and monoaralkyl ethers such as alpha glyceryl methyl phenyl, cresyl, and benzyl ethers are recommended.

The blushing of zein films can be prevented by soaking them in water to denature the protein but this is not feasible so antiblushing agents must be added.

Class A—Amino acid esters or their salts—The esters are also plasticizers for zein films. Suitable for glycine ethyl ester and its hydrochloride.

Class B—Amino guanidine or its salts, such as hydrochloride.

Class C—Semicarbazide or its salts, such as the hydrochloride.

Class D—Organic amino alcohol salts, for example monoethanolamine acetate.

In order to form strippable films from zein, formaldehyde must be added to fix the protein. Glyoxal is also advocated.

Casting of a dual film, one composed of zein mixtures cast on top of a film or moistureproof cellulose derivative, is simplified and the resultant product is easily removed from the casting surface. In the case of zein films, butyl stearate is recommended to give moisture transmission resistance. Alcohol-soluble nitrocellulose and phenol-formaldehyde resins may be incorporated in the zein film.

50. Hansen, D. W. (Prolamine Products, Inc.). Plasticized prolamine base composition. U. S. patent 2,115,716 (May 3, 1938) (Cl 106-38); *C.A.* **32:4689 (1938).**

This patent covers the same materials mentioned in U. S. patent 2,102,623.

51. Hansen, D. W. (Prolamine Products, Inc.). Manufacture of prolamine composition. U. S. patent 2,115,717 (May 3, 1938) (Cl 160-38); *C.A.* **32:4689 (1938);** *Chem. Zentr.* **1938, II:3468.**

This patent covers principles described in Hansen's earlier U. S. patents 1,992,122; 2,074,332; 2,047,961.

EDITOR'S NOTE: This article is in two parts. The second part will appear in the March issue of this magazine.

REPAIRS SPEEDED

DOWNTIME REDUCED

COSTS CUT . . .

by LUNKENHEIMER

Interchangeable Parts

Maintenance men find their job made easier and operating efficiency stepped up by Lunkenheimer interchangeablity of parts.

In servicing the Bronze "Renewo" and Iron Body "Ferrenewo" Valves—both regular and plug types—only *one stock of parts* is required. *All* parts (except bodies and bonnet rings) are made exactly the same and fit each other perfectly.

Repairs are more quickly and easily made, ordering and handling are simplified. The result: Lower maintenance cost and low ultimate valve cost.

Lunkenheimer part-interchangeability is fully illustrated and described in Circular No. 567. Ask your Lunkenheimer Distributor for a copy, or write direct.

BRONZE
200 lb. S. P.
"RENEWO"

IRON BODY
150 lb. S. P.
"FERRENEWO"

VALVE MAINTENANCE SIMPLIFIED!

All parts of these valves (except bodies and bonnet rings) are exactly the same. They fit each other perfectly.

For example—if you need a stem, disc, or seat ring for the "RENEWO", you can use the corresponding part of the "FERRENEWO", and vice versa.

Thus there are fewer parts to be carried, repairs are more quickly and easily made. The labor, time, and expense of valve maintenance is cut down—'way down!

SEE YOUR LUNKENHEIMER DISTRIBUTOR!

Lunkenheimer Distributors are located in all industrial centers. There is one near you—have him demonstrate with actual samples the interchangeability of parts in "RENEWO" and "FERRENEWO" Valves. It's a big time and money saver for any plant!

• SAVE THIS WAY, TOO! •

For severe throttling service, a regular type can be converted into a plug type, by simply changing the seat and disc, without taking the valve out of the line.

Thus it's not necessary to buy a whole new valve—just a matched set of plug type seat and disc which interchange perfectly in corresponding patterns and sizes in a range of pressures from 150 to 350 lb. S. P.

Lunkenheimer simplicity of design, minimum number of parts, and fine precision workmanship make this and other outstanding economies possible.

Fig. 16
300 lb. S. P.
Bronze "RENEWO"

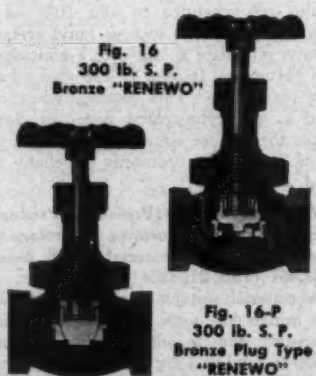
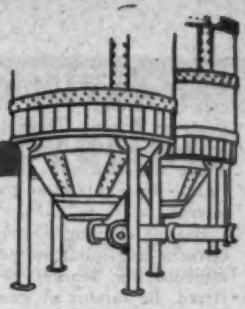


Fig. 16-P
300 lb. S. P.
Bronze Plug Type
"RENEWO"

THE LUNKENHEIMER CO., Cincinnati 14, Ohio

(OFFICES: NEW YORK 13, CHICAGO 6, BOSTON 10, PHILADELPHIA 7.
EXPORT DEPARTMENT: 318-322 HUDSON ST., NEW YORK 13, N. Y.)

Practical SHORTS



Readers are invited to submit short, practical articles for this department. The items should be original and should relate to ways and means of handling production and maintenance jobs. Where possible, articles should be illustrated. Rough sketches only are required. Payment will be made for acceptable items upon publication.

Hose in Gas Welding, Cutting, and Brazing

1. Fabric reinforced rubber hose has been found most suitable for welding and cutting operations. New hose is supplied with a talc on the inside surface. This dust should be blown out before using the hose by use of compressed air except oxygen hose, which shall be blown out with oxygen.

2. Flexible metal-covered hose shall not be used for welding and cutting operations. In case an explosion were to occur in a metallic hose, fragments of the metal would be blown in many directions.

3. Individual hose is supplied for oxygen and fuel gases. The hose provided for oxygen is supplied with different fittings than used on fuel gas hose. This is done because it is important not to interchange hose from service on one gas to another.

4. Do not permit the hose to come in contact with oil or grease, either internally or externally, as these cause rapid deterioration of the rubber and constitute a serious hazard with oxygen.

5. Do not use any lubricants, white lead, or pipe-fitting compounds when making connections.

6. Long hose should be avoided wherever possible. Where long hose is necessary, several standard lengths may be joined by special thread couplings which can be obtained from your stockroom.

7. Hose shall be protected from being trampled or run over. Kinks and tangles should be avoided. Do not leave the hose where it can be tripped over.

8. Protect hose at all times from sparks, hot slag, or hot objects.

9. Do not repair a leaky hose with tape.

10. Do not tape the oxygen and fuel gas hose together solidly. A piece of tape may be used every few feet.—*Safety for Gas Welding, Cutting, and Brazing Operators*, General Electric Co.

◆

Practical Methods of Lubricating Wire Rope

A wire rope that is to be lubricated should be clean and dry. Cleaning can be accomplished with a jet of air or steam, or with a wire brush.

Application of the lubricant to a clean, dry rope can be made in any one of several different ways.

An easy and effective method is illustrated in Figure 1. Simply dip a brush into the lubricant and apply. A rag or piece of sheepskin sometimes is used in place of a brush.

Figure 2 illustrates another simple method. In this case, the lubricant is applied by hand. The hands should be protected with leather gloves.

This method is especially good where a heavy, non-flowing lubricant is applied. A smoother, better application often is obtained by slightly heating the lubricant before use.

Figure 3 illustrates a method which employs a wooden trough or slush box for doing the job. The rope to be lubricated is led into the box over a sheave, then is passed under another sheave that is partially submerged in the lubricant—thus receiving its application, and finally is run over another sheave at the outgoing end of the box.

A rag or swab is held in place just before the rope leaves the box to wipe off any excess lubricant.

A slush box for lubricating a vertical rope is shown in Figure 4.

Proper lubrication of a wire rope helps to seal in the internal lubrication of the rope, and to keep out water and dirt. It also is a corrosion-preventive.

Regular inspection of a rope with frequent light application of lubricant produces better results than the less frequent application of a heavy coating.—Adapted from data of Macwhyte Company.

A Used Anti-Friction Bearing Should Be Cleaned Before Inspection

Don't try to judge the condition of a bearing until after it has been cleaned.

Don't spin dirty bearings. Rotate them slowly while washing.

Don't spin any bearings with an air hose. Rotate one ring by hand when using air to expose all parts of bearing.

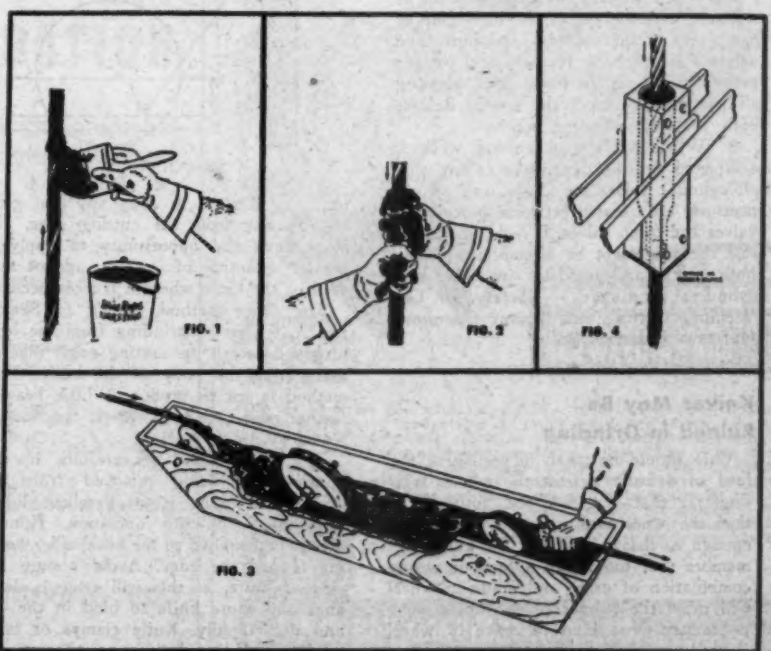
Bearings with a shield or seal on *one side only* should be washed, inspected and handled in the same manner as bearings without shields or seals.

Bearings with removable seals should be washed and inspected, after removal of seals in the same manner as bearings without seals.

Bearings with shields or seals *on both sides* should *not* be washed. Wipe them off to keep dirt from working inside. Smooth turning bearings can be coated with protective lubricant then wrapped and stored or used in their original application.

If bearings with two shields or seals stick or feel too rough for further use, send them to depots where special shielded bearing cleaning and lubricating equipment is available.

If a small tank and wire baskets for soaking and washing bearings are not available, a clean grease can or bucket filled with solvent can be used. Let the



bearings soak long enough to loosen the grease and dirt. That may take several hours or longer. Then slosh the bearing around near the top of the container, giving it a turn now and then until it is clean. Rinse in a *clean* container of *clean* solvent.

Bearing cleaning solutions are generally kerosene or gasoline but petroleum solvents intended for bearing cleaning are preferred. Be careful of gasoline containing ethyl or other anti-knock compounds, which are poisonous when absorbed in cuts or inhaled. All of these solvents are highly inflammable and precautions should be taken to prevent fires.

A short, clean bristle brush from which the bristles will not come out or break off is a help in removing dirt, scale or chips.—ANTI-FRICTION BEARING MANUFACTURERS ASSOCIATION, INC.

◆

Lighting and Shutting Off the Welding Torch

1. Open torch fuel gas valve and immediately ignite gas by using a friction lighter or other suitable source of ignition. Do not use matches for this purpose.

2. Adjust fuel gas valves for proper quantity of gas. If too much fuel gas is used, the flame will blow away from the tip. If too little fuel gas is used, the flame will snap back or backfire.

3. Open preheat oxygen valve until proper flame is obtained.

4. Open cutting oxygen valve and readjust oxygen preheat valve if necessary to obtain proper flame.

5. The equipment is now in readiness for work.

To Shut Off Torch

1. When welding or cutting work is finished, extinguish the flame by closing the preheat oxygen and fuel gas valves on the torch in the order mentioned.

2. When welding or cutting work is stopped for a period of one-half hour or more, close the cylinder or pipe line valves and open the fuel gas and oxygen preheat valves on the torch, thus releasing all gas pressure from the hose. Release both pressure adjusting screws.

3. When welding or cutting work is completed for the day, make certain that all cylinder valves are closed and all gas pressures are released between the cylinder valves and torch valves. It is recommended that the equipment be dismantled, placing hose, torch, and regulator in locker and cylinders in storage. — *Safety for Gas Welding, Cutting, and Brazing Operators*, GENERAL ELECTRIC CO.

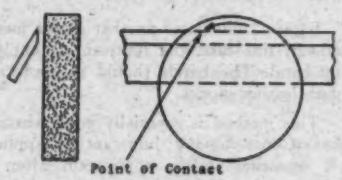
◆

Knives May Be Ruined in Grinding

Care should be taken in regulating the feed of a knife against the wheel. It is essential that the feed be adjusted so that the wheel will cut, but not heavy enough so that it will heat the knife. Remember that too heavy a feed or wrong combination of grain and grade in wheel will draw the temper of the knife edge, no matter what kind or make of wheel is used.

Cup, Ring and Segmental Wheels give best results at surface speeds of 3,500 to 4,500 fpm. Straight wheels will give satisfactory results at slightly higher speed of 4,000 to 5,000 fpm. Where speeds lower than those suggested are used, wheel wear is apt to be excessive and uneven while grinding action will be unsteady.

Knives may easily be ruined by excessive carriage feed and speed. When nicks in knife edge have to be ground out there

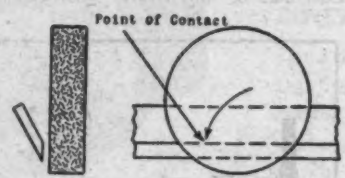


SKETCH NO. 4

is a great temptation to apply heavy feed and faster carriage travel in order to remove the greatest amount of material in the shortest time. Softer wheels will, in general, allow heavier feeds than harder ones, but any wheel forced beyond its capacity will generate excessive heat and destroy knives. Definite instructions can not be given for proper feed as there are so many varying conditions to consider. However, it is the opinion of experienced knife grinders generally that a light feed and fast table travel will produce much better results than heavy feed and slow table travel.

There are two methods of positioning the knife when grinding bevel:

The most popular one, shown in Sketch No. 4 is to hold the knife against the wheel so that the motion of the wheel is from the cutting edge toward the body of the knife. This method allows the wheel to cut the alloy steel edge first, carrying the chips toward the softer steel



SKETCH NO. 5

back and tending to carry any heat generated away from the cutting edge. It also allows the opportunity to apply a greater quantity of coolant against the edge of the knife where it is most needed.

The other method, shown in Sketch No. 5, is that of grinding from the heel of bevel toward the cutting edge; that is, away from the body of the knife. This method is apt to produce a little heavier feather edge, which, however, can be corrected by proper honing.

The knife should be carefully hand honed after being removed from the grinder. Kerosene is an excellent lubricant to use in this operation. Honing should be confined to the bevel side, working toward the edge. Avoid honing flat side of knife, as this will remove clearance and cause knife to bind in the cut and dull rapidly. Knife clamps or bolts used in holding knives on the grinder chuck should be uniformly tightened so that the knife is held perfectly straight while grinding.—*Keep Paper Knives Sharp*, SIMONDS SAW & STEEL CO.

◆

Replacing Blown Fuses

Speed in replacing blown fuses is usually essential. For this reason an extra set of fuses should be kept near every motor or fuse block.

Renewable fuses should not be renewed at the point where they are in use. By having an extra set ready, the entire cartridge can be replaced. Then when a number of blown fuses have accumulated, the maintenance man can renew them at his bench where he can take the necessary time to do it right. Then the fuses are more certain to be refilled properly. It is inadvisable to permit any and every employee to renew fuses. Proper renewal will save many unnecessary blows and will prevent destruction of the fuse cases. *Fuseology*, BUSSMAN MFG. CO.

◆

Charging Storage Batteries

Direct current only must be used to charge any storage battery. This can be obtained from a motor generator set, rectifier or d-c. bus in the plant.

The amount of charging necessary depends upon the number of ampere hours the battery has been discharged. Proper charging simply means charging sufficiently without overcharging, excessive gassing or overheating of the battery. Start charge rates are normally 3 to 4 times the published finishing rate. Automatic equipment properly adjusted will control the charge rate so that the rate will be the finishing rate or lower when the battery is gassing. Normally 8 hours are used to complete a charge.

The full time available for charging should be used. That is, if 8 hours are available for charge, this time should be used and no effort should be made to complete the charge in 3 or 4 hours. Rapid charging when unnecessary is to be discouraged as it may cause excessive temperatures and gassing which may shorten the life of the battery.

If it is necessary to put a battery to work before it has been charged to full capacity, the charging operation may be terminated.

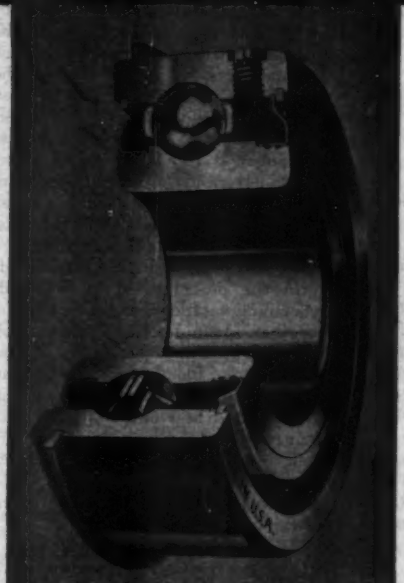
When a motive power battery is being charged, it is normal for the temperature of the battery to increase throughout the charge. The amount of temperature increase will vary depending upon ventilation and surrounding air temperature. The normal temperature increase for a battery is only 5 to 12 Fahr. during a complete recharge. If the temperature should increase more than this, it is an indication that the battery may be receiving more charge than required, or the rates are higher than necessary. The cause of overheating should be determined and condition remedied promptly.

Battery temperature should never exceed 110 Fahr. in normal service and then will only approach this value when the surrounding air temperature is above 90 Fahr.—*Philco Storage Batteries*, PHILCO CORPORATION.

DOUBLE YOUR GREASE CAPACITY—SIMPLIFY DESIGN—with

"Cartridge" Ball Bearings

(Patented)



"CARTRIDGE" Ball Bearings have been adopted by hundreds of firms in many lines of industry.

SOME OF THEIR ADVANTAGES:

Can be packed with at least 100% more grease than any self-sealed bearing — especially adapted, therefore, for continuous service for long periods.

Provide positive protection against foreign matter and absolute retention of lubricant—by the use of flanged metal shields, recessed inner ring construction, and two or more grease grooves—the combination affording a truly effective labyrinth.

Are equally efficient in retaining grease in horizontal or vertical position.

Metal shields, though rigidly locked by snap rings, are removable to facilitate inspection, cleaning or re-greasing of bearings.

Can be quickly regreased, either through "built-in" refilling plug opening or by removing metal shields.

Require no lock nuts on shaft or clamping means in housing, because of wide contact areas due to double-row width of both rings —which also prevent "cocking", slippage or "peening".

Reduce costs by simplifying design, eliminating protective closure parts, and saving attendant labor.

Available with shoulder ring, thus permitting a through bore in housing, the shoulder ring providing endwise location.

NORMA-HOFFMANN BEARINGS CORPN., STAMFORD, CONN. U.S.A.

HERMANN CLAFLIN REFINER FOR STOCK PREPARATION

The several combinations of fillings obtainable with various knife widths and materials and special hydrating filling makes it possible to cover a wide range.

Continuous and batch beating systems.

High strengths developed at high freeness.

Replaces brushing jordans where cutting is not a requisite, with substantial power saving.

Also manufacturers of pulp testing and sheet making apparatus. TAPPI standard.

THE HERMANN MANUFACTURING CO.
Lancaster, Ohio

Murco IMPROVED FLAT SCREEN

ALL PARTS IN CONTACT WITH PAPER STOCK are STAINLESS STEEL

VAT BOX MAY BE USED FOR RAPID CHANGE OF SCREEN PLATES AND WASHING OUT...

Illustrating flow box side Patent applied for

For use on either Fourdrinier or Cylinder machines this new improved screen is particularly adaptable for running different colors and grades of paper and boards—any operation where cleaning and preparing the screen for the next run demands no loss of time. Some of its special features are the Patented diaphragm stabilizer, tilt feature of Vat that saves labor and assures thorough cleaning of entire screen, low maintenance of drive, efficient and quiet operation of screen in its entirety, high production and low HP requirements. It is made of non-corrosive material at all places where metal is in direct contact with stock that has acid conditions.

Send for complete details now.

MURCO

D. J. MURRAY MANUFACTURING CO. WAUSAU WISCONSIN

Technique of Developing Company Policy*

By WILBUR M. McFEELY
Assistant to the Director of Industrial Relations
Riegel Paper Corporation

▶▶▶ Certain fundamental principles in developing sound company policies have stood the test of long experience, most of these having to do with the processes by which policy is determined and administered, rather than with programs as such. Wide differences still exist in industrial relations policies among various companies, which, however, is not surprising. Policies will remain dissimilar as long as men of different training, experience, insight, and understanding forge to the top levels of management. Although the trend in recent years is toward more uniform practices, it is still true that industrial relations methods are in that stage of evolution when differences are more pronounced than similarities.

In this evolutionary process, most companies have reached the stage where they realize the importance of reducing their policies to writing. Unless this is done, it is almost impossible to administer policies uniformly and without discrimination. If this premise is accepted and if a management decides to embark on such a program, several practical questions arise as to method and procedures.

Typical of the questions which must be answered before such a program is undertaken are the following:

What should be included in the individual policy statements? Should they be detailed, or should they be confined merely to a statement of general principle or management intent?

What group or groups should participate in the formulation of the policy statements?

How can management be assured that the policies as finally approved are understood and accepted by all levels of the supervisory and administrative staff?

The answers of the Riegel Paper Corporation management to those questions are presented in this article. The principles which we have adopted have stood the test of experience. Hence, we know they are sound. We do not claim to have developed procedures which are entirely original, neither do we presume that we have found the "one best way" for all companies. We are using essentially the same procedures in both our paper and textile companies. We believe, therefore, that other companies interested in this management problem may benefit by our experience, as we in turn have benefited from the experience of others.

Many companies are content with statements of policy which are couched in general terms, and do little more than establish management attitude and intent in a given situation. For example, it is possible to write in one paragraph a policy concerning wages:

It is the policy of the company to compensate employees in accordance with the principle of equal pay for equal work; to establish hourly rates for each job classification which reflect differences in skill and responsibility and other job factors, and which are at least equivalent to the rates paid for similar work in like industries in the area.

Such a statement of policy sets forth clearly management's approach to the question of how the wage structure is to be determined. It recognizes three fundamentals: equal pay when the employees' contributions are equal, proper job classifications established on the basis of the differentials in the employees' contributions, and a wage structure which bears a definite relationship to the going rates in the labor market. It can be further assumed that such a policy would not be adopted until consideration had been given to the company's competitive position and similar factors.

From the standpoint of the management personnel who must administer policy, however, the statement leaves many questions unanswered. For instance, a foreman would be faced with such questions as: Who determines when the employees' contributions are equal, and how is the determination made? How are differentials in skill, responsibility, and other job factors measured and translated into different hourly rates? How are comparable area rates determined? Specifically, how does the foreman participate in wage administration?

In recognition of the position of the members of the line management, who in the final analysis are the real personnel administrators, we believe a policy should be sufficiently detailed to provide answers and interpretations to as many questions and situations as can be anticipated while the policy is in the formative stage. A policy governing vacations, for example, should, in our opinion, include a consideration of such items as sick leaves, personal leave of absence, and occupational accidents involving lost time. It should set forth the procedure to be followed in scheduling vacations, and similarly consider other administrative problems. Policies written in this manner remain live issues, giving room for the entry of situations which had not been anticipated. Solutions to them must be found and fitted into the framework of the existing policy, or the policy must be amended as necessary. In this way the formulation of policy becomes and remains as dynamic as the operation of the business itself.

All members of our management staff, from top executives to the foremen, participate in the writing of policies. We firmly believe that no segment of management can successfully administer policy which it does not accept both intellectually and emotionally. To understand the letter of the policy is not enough; intellectual acceptance is necessary. The background of thinking upon which the policy is based must likewise be understood if in its administration the inevitable adjustments are to be made correctly. Emotional acceptance is essential because a man can put more enthusiasm and initiative behind that with which he has identified himself in spirit as well as in mind.

Admittedly, such a level of acceptance is difficult to attain. It will not be achieved overnight, even under the most ideal circumstances. But one thing is certain. Such adoption will never be obtained unless the ideas and experiences of all members of management are assembled and evaluated before the policies are finally approved.

The drawing of policies in our organization is done through a series of conference discussion meetings. The foremen are

(*) Reprinted from *Executives Service Bulletin*, published by the Policyholders Service Bureau, Group Division, Metropolitan Life Insurance Company.

TENAX
"TENAX FELTS ARE TOUGH"

UNEXCELLED for more than 50 years, there's a TENAX FELT to suit every need . . . . . to meet any and all conditions.

LOCKPORT FELT COMPANY
NEWFANE, N. Y.

the center of gravity in our industrial relations program. In them is vested the final authority to see that everything is carried out in accordance with the orders, plans, and policies laid down. They are at the end of the chain of management authority; below them that which is delegated is not further authority, but responsibility for the discharge of specific operational activities. In this position of immediate proximity to operations, they are in an unusually advantageous position to reflect the attitudes of the employees toward management's plans and policies. Hence, we consider the foremen's meetings to be the key to the success of our policy-writing method. Accordingly, we call it our "Foremen Conference Program."

Policy Statement Procedure

Although there are slight variations in the operation of the program in the several companies, due to differing conditions locally, the following is typical of the steps taken from the inception of a policy statement until it is finally approved.

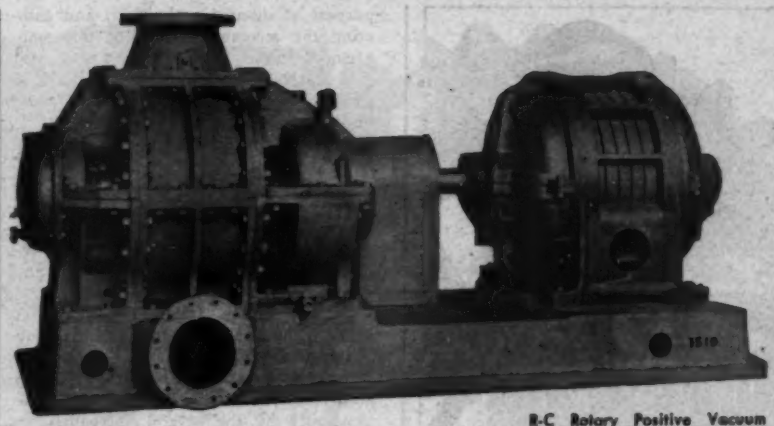
1. A policy statement is prepared in draft form by someone designated by top management. Depending upon the subject, this may be either the personnel director or a member of the line organization. During this preparatory stage, the person preparing the draft may confer with individuals either singly or in small selected groups. In this way the best of the existing practice is selected to go into the draft, legal and regulatory requirements are checked, and, if necessary, the experiences and practices of other companies are explored.

An obvious alternative method would be to present the topic in draft form to the discussion groups without preliminary guidance. The preparation of the first draft would then follow rather than precede the various group meetings. Theoretically, this would be the preferred procedure because it minimizes the possibility of the groups being influenced by what may seem to be the policy favored by top management. With certain groups this plan may be followed successfully. In a large situation, however, the advantages are more than offset by the fact that it is a cumbersome process. Furthermore, most groups of foremen do not have the breadth of knowledge regarding company-wide industrial relations practices, legal and regulatory requirements, and trends, to tackle adequately the problem of writing a policy from scratch.

We feel, therefore, that it is more practicable to have the preliminary research and planning done by a single individual or by a small group and then to present a draft for discussion to the various groups for them to tear apart and rewrite.

2. The operating head of the local plant, who may be the president or the general superintendent, holds a meeting with his division heads or superintendents. The draft is discussed and the recommendations of the group recorded. In some cases, depending upon the nature and extent of the recommendations, the draft may be revised before it is taken down to the next management level.

3. Each division superintendent holds a meeting with his general foreman for the



R-C Rotary Positive Vacuum Pump, delivering 4100 C.F.M. at 20" Mercury vacuum.

PROTECT PRODUCTION

WITH R-C *dual-ability*

ROTARY POSITIVE

Almost a century of successful performance proves the soundness of the Roots-Connersville Rotary Positive principle.

CENTRIFUGAL

R-C Centrifugal Blowers and Exhausters are available in a wide range of single and multi-stage units of advanced design.

VACUUM PUMPS are important factors in maintaining quality and quantity of production . . . and hence of profits. R-C *dual-ability* provides long-life, trouble-free operation, and high volumetric efficiency, thus reducing operating costs.

Constant improvements have been made in the design and construction of R-C Rotary Positive Vacuum Pumps, including readily accessible roller bearings; precision generated steel gears; gears and bearings fully protected from water damage; improved lubricating system; bottom discharge, eliminating stuffing box attention and effecting power savings.

For Central Vacuum Systems, which are rapidly gaining favor, either Roots-Connersville Rotary Positive or Centrifugal units, designed to handle large volumes at high vacuums, can be profitably used with individual vacuum controls.

R-C engineers will gladly study your plant requirements and then make a recommendation based on our long experience in the paper mill field. No obligation, of course.

ROOTS-CONNERSVILLE BLOWER CORPORATION

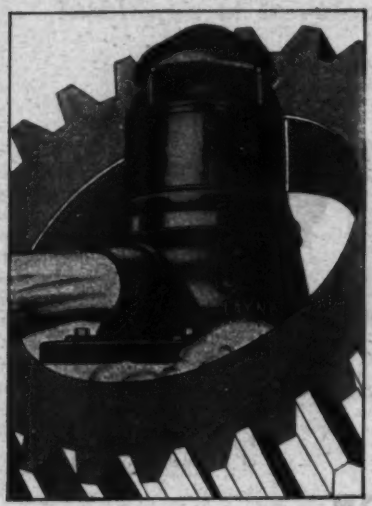
One of the Dresser Industries

602 Monroe Avenue, Connersville, Indiana

Roots Connersville Since 1854

DEPENDABLE VACUUM PUMPS

ROTARY POSITIVE AND CENTRIFUGAL BLOWERS • EXHAUSTERS • BOOSTERS
LIQUID AND VACUUM PUMPS • METERS • INERT GAS GENERATORS



The Biggest Industries

PREFER LAYNE WATER SYSTEMS

The modern industrial plant engineer is quick to show his preference for a Layne Water System. He knows—usually from first hand experience—that Layne Water Systems have many outstanding points of superiority. He knows that they produce the most water—at the lowest cost—and continue to give peak performance for years after other systems have failed.

Layne Water Systems can be bought for any capacity needed, from a few thousand to millions of gallons of water daily. But regardless of size, each will have the same high ratio of efficiency and the same long years of life. Furthermore, Layne engineers often obtain and produce more than an adequate supply of water in locations where others have failed.

Layne offers industrial plants the benefit of their long years of experience in planning water systems. An experienced engineer is available to study your problems and make recommendations — without obligation. For late literature, address Layne & Bowler, Inc., General Offices, Memphis 8, Tenn.

HIGHEST EFFICIENCY

Layne Vertical Turbine Pumps are now available in sizes to produce from 40 to 16,000 gallons of water per minute. Their high efficiency saves hundreds of dollars on power cost per year.

AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. * Layne-Atlantic Co., Norfolk, Va. * Layne-Central Co., Memphis, Tenn. * Layne-Northern Co., Mishawaka, Ind. * Layne-Louisiana Co., Lake Charles, La. * Louisiana Well Co., Monroe, La. * Layne-New York Co., New York City * Layne-Northwest Co., Milwaukee, Wis. * Layne-Ohio Co., Columbus, Ohio * Layne-Texas Co., Houston, Texas * Layne-Western Co., Kansas City, Mo. * Layne-Western Co. of Minnesota, Minneapolis, Minn. * International Water Supply Ltd., London, Ontario, Canada * Layne-Hispano Americana, S. A., Mexico, D. F.

LAYNE

WELL WATER SYSTEMS
VERTICAL TURBINE PUMPS

purpose of discussing the draft and gathering the recommendations of this management level.

4. Each general foreman conducts a similar meeting with the foremen under his supervision.

5. The conclusions and recommendations of all groups at this level are assembled and the cycle is reversed so that in the final stage the issues are resolved in the meeting of operating heads. If the changes are extensive, this cycle may be repeated before the policy is ready for final approval.

6. The policy statement as cleared through the local plant groups is then submitted to the New York office for final executive approval. This latter approval insures that the policies as developed independently by the several companies are reasonably consistent with each other, that they conform with legal requirements, and that they adhere to recognized, sound industrial relations practices.

Throughout all stages of the procedure, the personnel department at each of the plants and the central industrial relations office serve in an advisory capacity with regard to the content of the policies and also assist in guiding and developing the over-all program. It should be emphasized, however, that the meetings are sponsored and conducted by the line organization.

In connection with the program, it should be understood that the leaders have been given specific training in the techniques of conference leadership. In these training sessions, methods of leading a conference discussion are outlined in detail and demonstrated. As a follow-up of this formal training program the leaders are given individual assistance.

It is axiomatic that there is no better way to gain an understanding of the content of a policy and of the related administrative procedures than to participate in their formation. This is unquestionably the best way to make sure that the "why" of the policy is as well understood as the "how." The use of the conference discussion method also presents further opportunities to test a group's understanding of policy. For example, if a particular section of a draft under discussion seems to be accepted by the group, without recommended changes, a skilled leader can easily check the group's understanding by posing specific problems before the group members and asking them to state how the policy would be applied. In this way, weaknesses in understanding are quickly disclosed. Or, the leader may use "true and false" type questions which the group members are asked to answer and then to substantiate. Other similar methods are well known to any experienced discussion leader.

Each meeting, therefore, serves a dual purpose. First, it provides a method whereby the ideas and experiences of all the management personnel can be given full consideration in the development of equitable, workable policies. Secondly, it serves as a training vehicle by means of which management can be reasonably assured that its policies are understood and accepted by all those charged with their administration.

Convention Papers . . . Abridged

The following abridgments are from papers presented at the annual meeting of the Technical Section of the Canadian Pulp and Paper Association, held in Montreal, Quebec, January 23 to 25, 1946.

A Review of the Literature Relating to Printability and Allied Subjects (1944-1945)

S. M. CHAPMAN
Pulp and Paper Research Institute of Canada

This bibliography is intended to cover approximately the twelve-month period from September 1944 to September 1945. No attempt has been made to cover all articles relating to printing or papermaking. The papers abstracted refer mainly to printability research and testing or to the printing-use requirements of paper or paperboard. Some articles dealing with printing ink and printing processes are also included.

According to Simmons (*Paper Trade J.* 120, 24:35-8, June 14, 1945); (*Tech. Assoc. Papers* 28:436-9, 1945) good printing requires a favorable balance between the paper and the plates, press, printing rollers, printing ink and pressman. Printing variables include adjustments to aid in ink distribution and ink film thickness and changes in the printing pressure. The printing ink is the only component that lends itself to change at the press. Plates, rollers, and paper cannot be altered other than to exchange them for other plates, rollers, and paper.

Beierwaltes (*Paper Ind. and P. World* 27, 1:57-9, April, 1945) advised the papermaker to learn more about printing and the printer's problems. He recommends that the paper technician should make regular visits to printing plants to observe and discuss printing. Study of press manufacturers' literature is also advised. The addition of a proof press, or better still a typical commercial press, to the paper mill laboratory is highly recommended.

Anon (*American Pressman* 55, 7-18, June, 1945) suggested that papers should be manufactured with specific properties to suit them for the use to which they are to be put. For example, it is probable that newsprint requires a certain amount of softness, opacity, ink penetration, affinity for ink, strength, cleanliness, stiffness, etc. Unfortunately, however, no one knows exactly what are the optimum properties for newsprint. The same may be said for other papers. Steps should be

The modern AK Knife Grinder with completely automatic operation, simplified controls, versatile performance for a wide range of knife grinding.

Shown at left is a Hanchett heavy-duty AK Knife Grinder which has given accurate, dependable service for many years, grinding cutter and trimmer knives in a large eastern pulp and paper mill.

HANCHETT A-K

Knife Grinders are built for long, efficient service

If you're looking for ways to cut costs in your plant, investigate the new Hanchett AK—a precision, time-saving machine that will grind all your knives and shear blades quickly and with dependable accuracy.

Get your copy of Bulletin 178-11 PWB today!

ELECTRIC BRAZERS
ANVILS AND HAMMERS
BAND WHEEL GRINDERS
MISCELLANEOUS SAW & KNIFE FITTING EQUIPMENT

HANCHETT MANUFACTURING CO.
SAW AND KNIFE FITTING MACHINE DIVISION
BIG RAPIDS, MICHIGAN U.S.A.

★ SAW SHARPENERS
★ SAW STRETCHERS
★ KNIFE GRINDERS
★ SWAGES AND SHAPERS
★ WELDING CLAMPS

taken to determine how to best balance these properties.

Buss (*American Pressman* 55, 11-42, 44, Oct., 1945) discussed paper properties, their connection with printing, and test methods for their evaluation. From the standpoint of printing the most important paper properties are thought to be: finish, formation, bulk, hardness, opacity, and brightness.

Carlsson (*Svensk Papperstidning* 47, 23:569-80, Dec. 15, 1944; abstracted in *Paper Making & the Printer* 63:20, Spring 1945; *B.I.P.C.* 15, 7:251-2, March, 1945) (abstract only available) in discussing paper properties in relation to printing, pointed out that the printers' demands are: (a) the paper must be strong enough to stand the mechanical strains it will be subjected to in the printing press, (b) it must run through the press without trouble, (c) it must absorb the ink rapidly, (d) it must allow as perfect a reproduction of the printing form as possible, and (e) it must not damage the printing form.

Grant (*Pulp & Paper Mag. Can.* 46, 3:149-151, 6th Wartimeissue, Feb. 1945) discussed the properties of newsprint from the user's viewpoint. He drew attention to the two different points of view regarding newsprint. First there is the production point of view held by the circulation department, and which is concerned with the running properties of the paper, and secondly, there is the printability viewpoint of the advertising department.

A good printing newsprint should be uniform, light in weight, opaque, dense, thick, have a soft high surface smoothness on both sides and a high rate of oil absorption.

One of the most common troubles in the press room is breaking of the newsprint in the press. The greatest factor in breaks due to the paper is non-uniformity in winding. Another great contributor is insufficient moisture in the paper. Paper of 10-12% moisture content would run with fewer breaks and static would be less.

Harrison (*Paper-Maker* 109, Midsummer special: 4-5, 7-1, 8, 10, 13, 1945; *World's Paper Trade Rev.* 123, 25:1442, 1447-8, 1450; no. 26:1484, 1520-21, June 22, 29, 1945; 124, 4:187-8, 224, 226, July 27, 1945) presented a paper on the definition and measurement of gloss and smoothness. This is an introductory study intended to be the first of three or four papers on the subject. Finish is described as those surface characteristics of a sheet of paper which affect its feel and appearance. It is a composite, not a single property, and, therefore, cannot be measured or expressed by a single figure. Gloss is similar to glare or lustre and refers to the sudden and often local increase in brightness of a sheet of paper when it is illuminated by a small source of light and viewed at certain definite angles. Another property of glossy surfaces, particularly of surfaces of high gloss, is that it is possible to see more or less distinct images in them. The distinctness of image decreases with decreasing gloss. Lustre and distinctness of image usually go together but are different sensations. Lustre refers more to the sudden selective reflection of light. Gloss is a combination of lustre and distinctness of image. Glare is the hurtful effect of excessively bright light.

The presence of small local irregularities gives rise to the sensation of roughness and the arrangement or distribution of these irregularities leads to an idea of surface pattern or texture. Both gloss and texture are optical properties. Roughness on the other hand is generally more apparent to the sense of touch. Frictional resistance is also apparent to the touch but it is not always identical to roughness or texture.

Anon (*American Pressman* 54, 12:9, 12, Nov. 1944) suggested that papermakers should wherever possible be supplied with full information regarding the requirements that must be met to provide a paper suitable for any given method of printing.

Liesegang (*Fette u. Seifen* 50:437, 1943; C.A. 38, 22:6559[9], Nov. 20, 1944) (abstract only available) pointed out that the degree of oil and water absorption is not necessarily controlled by the porosity. The sizing and the dyestuff used are also important factors.

Haffner and Kobe (*Pulp & Paper Ind.* 19; 1:49-52, Jan. 1945) evaluated the properties of diatomaceous earth as a filler for newsprint. They found the brightness to be superior to clay but the retention was irregular. The opacity was found to be greatly increased. As with clay fillers the specific volume was reduced but to a lesser extent. Small amounts did

not adversely affect the Mullen or tear strength of the paper.

Printing tests were made on a proof press and they showed that there is a fairly uniform ink transfer together with somewhat clearer prints with less ink and less liability to smudging.

Buchdahl and Polglase (*Paper Trade J.* 121, 3:41-3, July 19, 1945; Tech. Assoc. Papers 28:136-8, 1945) described two methods for determining the amount of ink on trial prints. The first of these methods makes use of an extractable dye (methyl violet was used) in the ink. A given area of the print is extracted and the amount of dye present determined colorimetrically, whence the amount of ink on the print can be calculated. The second method makes use of a radioactive tracer material in the ink and its subsequent quantitative determination in the print by the use of the conventional Geiger counter. Radioactive phosphorus in the form of PCl_5 was used in the experiments described.

Reed (*Paper Trade J.* 120, 25:76, 78, 80, June 21, 1945) investigated the factors controlling the drying of lithographic ink. In the case of coated papers, it was found that the rate of drying varies greatly from one coated paper to another. Investigation showed that paper can affect the drying rate in at least two ways: (i) its surface absorbency determines the rate of setting and (ii) its chemical properties (*p*H) retard or accelerate the drying of ink by oxidation. Coatings which have *p*H values above 8.0 were found to be most conducive to rapid drying at all humidities but particularly so at high humidities. Coatings with *p*H values below 8.0 lead to slower drying even at low humidities but retard drying to a much greater extent at high humidities than do the more alkaline coatings. The *p*H of an uncoated paper was found to bear no apparent relation to its drying properties. Uncoated papers are usually below *p*H 6.0.

$CaCO_3$ coatings tend to produce good drying properties but since the alkalinity of the paper also depends on the alkali used in dissolving the casein, papers with good drying properties need not necessarily contain $CaCO_3$.

There is a practical limit to the alkalinity of a coated paper since highly alkaline coatings tend to neutralize the acid in the printing press fountain solutions and thus prevent the maintenance of the desirable acidity of *p*H about 3.8. Too high a *p*H in the fountain solution leads to scumming or tinting of the plates.

This article is a condensation of a portion of Research Bulletin No. 13 of the Lithographic Technical Foundation, entitled "The Drying of Lithographic Ink." (Reed, Robert F., Cadwell, Leonard E., and Benemelis, Robert L.: Research Bulletin No. 13, Lithographic Technical Foundation, Inc., New York, 1944).

Anon (*Modern Lithography* 13, 4:28-9, 77, April, 1945) gave a digest of another portion of this same report under the title of "Ink Drying Troubles." It is pointed out that there are two stages in the drying process; (i) The setting of the ink (ii) solidification by polymerization and oxidation.

Diefenbach (*Am. Ink Maker* 22, 9:63, 65, 71, 1944; C.A. 38, 22:6578[8], Nov. 20, 1944, *B.I.P.C.* 15, 3:87, Nov. 1944) (abstract only available) described a method of analysis for news ink which involves extraction in a Soxhlet extractor with petroleum ether using a thimble, followed by additional extractions with benzene and with ethyl alcohol. The extracts are then examined chemically. The emphasis is on the ink vehicle.

Bartlett (*Off. Dig.* 1945:243:54; *Rev. Paint Col. Varnish & Allied Ind.* 18, 105:136, May-June, 1945; *Patra J. & Printing Abs.* 9, 2:71, Oct. 1945) (abstract only available) developed an apparatus which can be used to determine the drying time of printing inks or paints. It permits standardization of the time of contact and the pressure applied in a finger-touch determination. Reproducible results are claimed although they do not necessarily agree with other drying-time machines which are discussed.

Anon (*A.N.P.A. Mech. Dept. Bull. No. 313; Printing Equip. Eng.* 70, 6:16, Sept. 1945) gave an account of the *Chicago Tribune* experiments with steam-set inks for newspaper printing.

Banks (*Patra J.* 8, 2:50-4, Nov. 1944) gave an elementary discussion of the transformation of liquids to solids with particular reference to the drying of printing ink. This transformation may occur in two ways: (i) physical methods in which no change in the chemical nature occurs and which are reversible; (ii) processes in which a chemical change does occur and which are not usually reversible.

Buchdahl and Thimm (*Applied Physics* 16:344-50, 1945; C.A. 39, 18:4237[2], Sept. 20, 1945) (extract only available) interpreted the performance of printing inks in terms of their rheological properties as measured in a rotational (Stormer) viscosimeter.

Watson and Foster (*American Pressman* 55, 7:12, 14, June, 1945) described the services the ink service man renders to the printer. In most cases it is found that the standard printing inks are satisfactory.

Light weight, transparent papers now used have required changes in the inks and sometimes the use of slower press speeds. Lower quality coatings have also been a big problem. Lack of clay-coated and the better patent-coated boards in folding box production led to troubles in color reproduction.

Anon (*Am. Ink Maker* 22, 12:21-4, Dec. 1944; *B.I.P.C.* 15, 6:216, Feb. 1945) (abstract only available) in writing about heat-set litho inks pointed out that the main difference between these inks and similar inks for letterpress is in the selection of the solvent. Litho inks require a compound that does not emulsify in water or affect the rubber blanket.

Offset stocks, being absorbent, have always held the advantage in ink drying over litho coated stock. Offset coatings must withstand both water and the acid of the fountain solution. They must also

WHERE DECAY, ODOR, TASTE, OR ACID IS A PROBLEM, USE

Tidewater

RED CYPRESS

Read What Authorities Say About Its Superior Qualities

Romeyn Beck Hough, author of "American Woods", says of Cypress "Its great durability, immunity from the attacks of parasites, and non-liability to great shrinking or warping make it one of our most valuable woods for all woodwork exposed to weather, for tank construction, cooperage, etc. Its value . . . is enhanced by its comparative freedom from coloring or flavoring ingredients".

Phillips A. Hayward, author of the volume on Wood in Chandler Cyclopedia, says that Cypress is "easy to work, available in large dimensions, and resistant to decay". It is also "resistant to changes in moisture, resistant to acids, and imparts neither color nor taste."

For a hundred industrial needs, TIDEWATER Red Cypress is the right answer. Write today for full details.

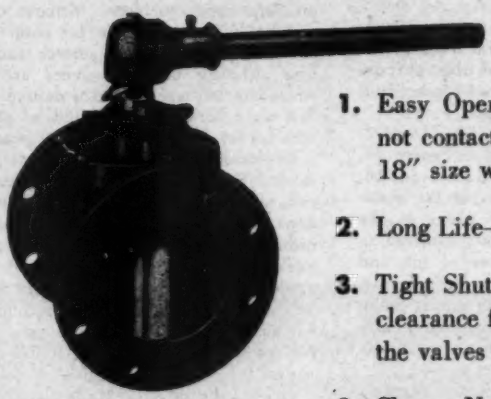
Tidewater RED CYPRESS

The Red Cypress "The Wood Eternal"

FLEISHEL LUMBER CO.

4234 DUNCAN AVE. • ST. LOUIS 10, MO. • NEWSTEAD 2100

A SUPERIOR PULP AND PAPER STOCK VALVE



by DeZurik

1. Easy Operating—Cannot stick or bind because plug does not contact seat when being turned. A 30″ lever operates 18″ size with ease.
2. Long Life—The design automatically compensates for wear.
3. Tight Shut Off—Because the design does not depend upon clearance fitting between plug and body for easy operation, the valves provide a tighter shut off.
4. Clean—No pockets or bonnet cavities—no place for dirt to form.
5. Most Complete Line—Lever and cylinder operated valves in 2-way, angle, 3-way, 4-way, and 5-way styles made of a wide range of materials.

Write for Valve Catalog.

DeZURIK SHOWER COMPANY, SARTELL, MINNESOTA

be hard and durable to withstand the pull of the rubber blanket and the 100% impression used on the offset presses. The body stock must be stronger than in the case of letterpress coated papers. A successful heat-set ink for litho use must be stable on the press and must not dry while running or during brief shut-downs, yet the solvent must evaporate fast enough to permit drying by passage through the heat zone or drum.

Diefenbach (*A.S.P.A. Mech. Bull. No.* 309:1-2, Jan. 31, 1945) discussed probable postwar newspaper inks. Aniline toners will again be incorporated in news blacks. Radical developments will not be available in the immediate future but will be forthcoming at a later date.

St. John (*Inland Printer* 114, 4:57, Jan. 1945) discussed the scumming of offset printing plates. This trouble can arise from a number of different sources among which the paper may be one. Paper fluff, dust or ease of picking may lead to it; the paper should, therefore, be sized for offset use. Grit in the paper may cause abrasion of the plate and consequent scumming. Alum used in the sizing of the paper may be extracted by the damping water on the press and cause scumming. Casein in coated papers may lead to this trouble, but it is unusual with high grade coated paper. If glue or starch is used in the coating instead of casein, the trouble does not occur.

The same author (St. John, Eugene; *Inland Printer* 116, 1:66-7, October, 1945) pointed out that picking is a frequent wintertime problem which is most often encountered when printing from halftones or solid plates on coated paper. When this trouble occurs either the coating of the paper is not well bonded to the body stock or the ink is too heavy for the coating. Lack of thorough make-ready on the press may often be the basic cause since it induces the use of an excess of ink.

White spots in the solid areas of the print are not always due to picking. Other causes mentioned are: paper dust or lint and minute holes in the surface of the paper.

Kilheffer (*American Pressman* 55, 7:25-7, June, 1945) defined offsetting as the transfer of wet ink on one sheet to the back of the next sheet that comes in contact with it. A table of causes of offset troubles is presented giving 27 different causes under the following headings: ink, inking, paper, atmospheric conditions, make-ready, machine adjustment, handling, static, and excessive ink.

Parker (*Printing Equip. Eng.* 70, 6-25, Sept., 1945) discussed first impression offset in newspaper work and pointed out that excessive amounts of ink with a light impression will not eliminate the trouble. Small amounts of ink and higher printing pressures will lead to cleaner and sharper printing with less offset trouble. The heavier bodies the ink that can be run the more dense will be the color and consequently the less ink which must be run and the smaller the danger of offset.

Case (*Paper Trade J.* 121, 7-38-9, Aug. 16, 1945; *Tech. Assoc. Papers* 28:231-2, 1945) pointed out that the application of machine coatings is increasing, especially in catalogue work, because better quality printing can be obtained at lower cost. The regular brush coated paper was found to be impractical for this work and uncoated paper was likewise unsatisfactory.

A needed development is for a machine coated paper suitable for high grade four-color rotogravure printing on high speed rotary presses with folders. Paper of this type with greater heat resistance is also needed for use in heat-set printing.

Massey (*Tech. Assoc. Papers* 28:404-6, 1945; *Paper Trade J.* 120, 21:39-41, May 24, 1945; *Paper Maker* 110, 1:31-2, 34, July, 1945) and Egan (*Tech. Assoc. Papers* 28:259-65, 1945) both discussed the growing importance of machine coated paper, its production, and its advantages for various types of printing.

McAneny (*Paper Ind.* 26, 5:644-5, Aug. 1944) gave the printers' ideas on coated papers.

Clarke, Robinson, and Harrison (*Paper-Maker* 110, 1:ts 4-7, July, 1945; *World's Paper Trade Rev.* 124, 1:11-2, 16; 124, 2:87-8,93, July 6, 13, 1945) gave details regarding the manufacture of body stock for coatings and its desirable properties.

Alden (*Year Book and Program*, Am. Pulp & Paper Mill Supts. Assoc., 294-4, 1944. *B.I.P.C.* 15, 4:133, Nov. 1944) (abstract only available) discussed the relative merits of machine and conversion coating. Machine coated sheets have relatively light weight coatings using starch

as the adhesive. They give excellent printing results but they do not equal casein in imparting color, finish, and other desirable printing properties. Unless casein can be used in machine coating methods or the starch satisfactorily waterproofed, the machine coated sheet will not be suitable for the offset process.

Slater (*Printing Equip. Eng.* 70, 5:28, 84-6, Aug., 1945) recommends the use of a sling psychrometer for the determination of relative humidity in preference to the stationary type or the dial type. If the stationary type is used, the wet bulb should be fanned before taking readings. Tests made with and without fanning the wet bulb gave 45 and 35% respectively.

Paper at low humidities is hard and brittle and it is difficult for the ink to penetrate. Increase in humidity causes the fibers of the sheet to expand and the paper becomes more porous to the point where the fibers become more or less ink repellent. Changes in the sheet size with humidity variations are discussed in connection with their effect on register on the presses. Optimum printing conditions are said to include paper with a moisture content of 5% in a room at 78 Fahr. and relative humidity 40%.

Beadie (*Inland Printer* 114, 4:31-4, Jan. 1945) also cited the advantages of air-conditioning as a practical investment with special reference to offset printing.

Pheby (*Paper & Print.* 18, 2:70, Summer 1945; *Patra J. & Printing Abstracts*, 9, 2:69, Oct. 1945) (abstract only available) gave an account of the advantages of air-conditioning the printing office with special reference to its value for personnel, register, rollers, etc.

Crump (*Paper Trade J.* 121, 18:34-36, Nov. 1, 1945; *Tech. Assoc. Papers* 28:242-4, 1945) described the practices of map-making.

Most maps are produced in color by offset lithography. The general trend in the manufacture of papers for this purpose has been towards a lower rag content and decreased weight and thickness.

Bullen (*Paper Trade J.* 120, 18:41-2, May 3, 1945; *Tech. Assoc. Papers* 28, 295-6, 1945: *Paper-Maker* 110, 1:36, 16, July, 1945) drew attention to the possibilities of plastic printing plates in the newspaper field. They are considered to be more faithful conductors of ink and allow sharper and cleaner reproduction. Since the plastic flows freely during molding, it follows the mold contours faithfully and thus leads to a more accurate duplicate than the stereotype now used.

Practical trials have shown excellent results in both book and four-color work. The light weight of the plastic plate is one of its most important assets and permits great savings in air express shipments and reduction of vibration in rotary presses at high speeds.

Anon (*Indian Print. & Paper*, 10, 3:45, April, 1945; *B.I.P.C.* 16, 1:26, Sept. 1945) (abstract only available) gave notes and diagrams to aid in recognizing the most important types of printing processes.

Fisher (*American Pressman* 55, 7:34, June, 1945) gave advice on the use of a proof press with special reference to its use for the making of production proofs.

Arend (*Paper & Print.* 18, 1:8-9, Spring, 1945; *B.I.P.C.* 15, 10:384, June, 1945) (abstract only available) listed the types of half-tone screens to be used for different paper surfaces. Screens of 65 and 85 lines are suitable for cover stock and newsprint of rough surface and texture although 60 line screens are used where not too much detail is desired. Laid and wove bond papers should be printed with an 85 line screen but this screen is not recommended for coated or dull-coated stock. Screens of 100 and 110 lines are not usually considered safe for use on news or laid stocks but they are good for ordinary bond and low-grade coated stocks. For first grade coated papers, good grades of dull-coated, and half-tone bonds, 133 and 150 line screens are recommended, although 120 line screens may suffice for second grade enamels and dull coated papers. For the examination of half-tone dots, etc., the direct contact microscope is recommended.

Simmons (*Paper Trade J.* 121, 9:90, Aug. 30, 1945; *Tech. Assoc. Papers* 28:177, 1945) reported on the activities of the Graphic Arts Committee of TAPPI for the year 1944. The committee is currently working on surface strength, smoothness, air-resistance, a bibliography of printing processes, the effect of humidity and temperature on paper, ink, press rollers, and printing processes in general, the covering power of printing ink, and the correlation of laboratory tests with the printing quality of paper.

The same author (Simmons, R. H.; *Paper Trade J.* 121, 12:36-9, Sept. 20, 1945; *Tech. Assoc. Papers* 28:216-8, 1945) discussed developments in the field of graphic arts during the year 1944 with special reference to paper, printing inks and printing processes.

Roesen (*A.N.P.A. Mech. Bull. No.* 308, 319-24, Dec. 29, 1944) gave a short history of newspaper printing presses and predicted that presses of the future will be designed to even greater precision than those of today and they will permit full color printing with the same speed as black and white, no hand registering or make-ready being required.

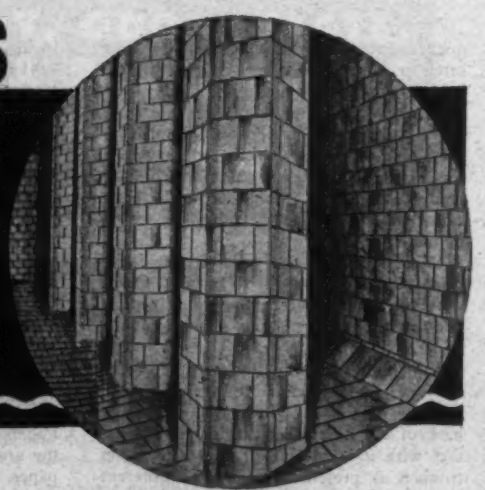
Rowland and Van den Akker (U. S. Patent No. 2,353,852, July 18, 1944: C. A. 38, 21:6096[1], Nov. 10, 1944) have obtained a patent on a method of determining the receptivity of sheet materials such as paper to coatings, inks, etc. The sample is supported on a resilient surface and a substantial quantity of the fluid testing material is applied to a restricted area and spread rapidly, as for example, with a motor operated doctor blade. At the same time, as much as possible of the spread material is removed from the surface with suction thus applying a very thin coating of the testing material as rapidly as possible without appreciable mechanical working of the surface. The resulting pattern is evaluated by comparison with known standards.

A patent issued to Watson and Anderson (British patent No. 570,411; *Patra J. & Printing Abstracts* 9, 2:82, Oct. 1945) (abstract only available) describes

STEBBINS

Quality Linings

PROVE ECONOMICAL



Stebbins linings are economical because the complete installation; materials used, design, and construction are all engineered by pulp and paper mill lining experts. Stebbins gives you all this in one service, involving: (1) an analysis of your needs, (2) a design for service and durability, (3) a construction for economy and efficiency. One contract, one responsibility covers the complete installation.

For quality linings — consult Stebbins.

Stebbins Engineering and Manufacturing Company

EASTERN BOULEVARD, WATERTOWN, NEW YORK

a method of manufacturing paper which is resistant to changes in dimension on exposure to variations in relative humidity and temperature. The wet paper web is pressed into contact with a carrier which has passed through a bath containing the constituents of a thermosetting resin. The paper is then dried, thus setting the resin. The final paper contains 2.3% of the resin on the basis of the dry weight of the paper.

Armstrong (*Illinois Tech. Eng.* 10, 4:28-9, May, 1945; *B.I.P.C.* 15, 12:473, Aug. 1945) (abstract only available) devised an apparatus for evaluating the roughness of coated tracing cloth and other similar coated fabrics or papers which possess a hard surface. A narrow strip of sample of great length is fastened to a roll which revolves at 40 r.p.m. A stylus contacts the surface of the sample and rides freely over it. The movement of this stylus is converted to electrical impulses and then recorded. The apparatus indicates the average roughness level rather than individual variations or absolute roughness. A path of over 30 yards of sample is covered in less than 5 minutes.

Anon (*Paper & Print.* 18, 1:23-4, Spring, 1945; *B.I.P.C.* 15, 10:379, June, 1945) (abstract only available) predicted that demands for printing paper in the future will be based on "fitness for the purpose." It is expected that letterpress and coated art papers will retain their popularity. They are not likely to be superseded by offset and gravure.

FLORIDA PULP and PAPER COMPANY

Depends upon

WARREN PUMPS

for important services at their modern mill at Pensacola, Florida, which was completed in 1941 and which was designed and built to make bleached and unbleached specialty papers. Original equipment included fifty-four Warren Pumps and several others have since been added — all giving on-the-job dependability with economical operating and maintenance costs.

Warren Type S.O.D. Pump handling 3½" Stock

Paper Machine Fan Pump

for every Pulp and Paper Mill Service

Specify Dependable

WARREN PUMPS

Pump for weak liquor to recovery room

WARREN STEAM PUMP CO., INC.

WARREN, MASSACHUSETTS

A Review of Alkaline Pulping Procedures in Canadian Mills

G. F. ALLO
Control Superintendent
Bathurst Power and Paper Co., Ltd.

In Canada, there are, at the present time, nine mills producing sulphate and one mill producing soda pulp.

The total annual production of alkaline pulps is approximately as follows:

	Tons
Unbleached sulphate pulp..	390,000
Bleached sulphate pulp....	75,000
Bleached soda pulp.....	35,000
Total alkaline pulp.....	500,000

Most of the pulp produced is further processed at the mills into wrapping, sheathing, envelope, toweling, twisting and specialty papers, and into kraft liner, corrugating and other boards.

There are five Canadian sulphate mills either in process of construction, or planned for the near future. It is estimated that, with the completion of new mills, a total production of alkaline pulp in the vicinity of 800,000 tons per year may be expected. This would represent an increase of 60 per cent over present production.

The alkaline mills have kept well to the forefront in the development and application of new and improved equipment to the process. Constant efforts have been put forth to improve quality, eliminate wastes and produce more economically.

Brief mention is made of the following:

1) Chip packers have been used to increase digester capacity.

2) Circulating systems and indirect heating have helped to increase quality and uniformity, and to aid in steam economy.

3) Digester blowdown recovery systems utilize waste heat.

4) Liquor recovery has been aided by new and improved pulp washers.

5) Recording and controlling instruments have probably found a wider use in alkaline pulping than in any other pulping process.

6) The application of electrical precipitation of solids in stack gases has helped to reduce chemical costs.

At the present time, it may safely be said that practically all Canadian sulphate pulp is produced from coniferous woods such as spruce, fir and pine. It is likely that for the production of highest quality long-fibered pulp these woods will continue to be used. However, many mills are attempting to find a profitable use for the large amount of deciduous woods such as maple, beech, poplar and birch which are growing on their limits.

Some mills have cooked small percentages of hardwoods along with softwoods without any change in cooking procedure. This seems to result generally in a small decrease in the strength of the pulp.

It is generally conceded that for optimum results, hardwoods and softwoods should be cooked separately. This would seem logical in view of the differences in fiber structure, ease of liquor penetration, action of the alkali, and other factors. The differences in the physical properties of

VORTRAPS

As modern in technique as

JET PROPULSION

Just as in the Jet Propulsion engine, where powerful fundamental forces are put to work, so in the Vortrap, centrifugal force whirls the impurities out of paper-making stock. Vortraps clean pulp and paper stock of sand, grit, filings, scale, bark specks, and other dirt simply, effectively and economically. They operate 24 hours a day, have no moving parts, are low in first cost, have low power consumption and occupy little space.

Write for Bulletin No. 209. It is interesting and informative.

ONLY NICHOLS MAKES VORTRAPS

NICHOLS

ENGINEERING & NERCO RESEARCH CORP.

60 WALL TOWER
NEW YORK 5, N. Y.

UNIVERSITY TOWER BLDG.
MONTREAL, P. Q.

pulps produced from soft and hardwoods are also so great, that separate cooking and later blending if desired, would seem to be the correct procedure. Hardwood pulps are short fibered, slower, and possess only 50 to 75 per cent of the strength of softwood pulps.

Many of the mills have experimented with separate cooking of hardwoods and some are currently producing hardwood sulphite pulp. There is, however, very little information available on the best procedure to follow. Cooks of birch have been made using exactly the same procedure and the same alkali charge per digester, as would be used in cooking spruce and fir. In other cooks of hardwood, the charge of alkali per digester was increased over that for a softwood cook, in the ratio of the wood densities, a longer period of pressure raising was used, with a slightly shorter time at full pressure. In both cases, a satisfactory pulp was claimed to have been produced.

There is room for a great deal of fundamental investigation on the cooking, and on the subsequent use of pulp from different species of wood.

Most mills have probably given some thought to selective grading of wood as to species, density and moisture, but until such time as it can be demonstrated that the cost of grading will be paid for in better yield and quality of pulp, it is unlikely that it will become general practice.

In common with all pulping procedures, the amount of cleaning to which the wood is subjected depends entirely on the end use of the pulp.

Pulp to be used in container board and cheaper wrappings need not be done very clean, and it is often the practice to use some unbarked wood in pulping for these grades. There are in the literature, references to the effect that a large proportion of chemicals is consumed in pulping bark, and that the yield pulp is small. One authority states that over a range of 0 to 25 per cent bark, the active alkali required per ton of pulp is a straight line function of the percentage of bark, and increases at the rate of 13.4 lb. of active alkali for each per cent of bark.

The average sizes of chips made in Canadian mills does not vary greatly, the range being ½" to ¾" with the latter by far the most common.

Chips over one inch size are separated and sent to a crusher or re-chipper, while sawdust passing a ⅛" square mesh is rejected and usually burned in a refuse boiler though occasionally wasted.

The general opinion of the industry is, that within reasonable limits, chip size is not important, but that uniformity of size is definitely to be desired.

Alkaline liquors penetrate the wood more rapidly than acid, so that a longer chip may be used than for the sulphite process. This has certain advantages in reduced power consumption in chipping and a higher percentage of long fibers in the pulp. Investigations on just how far it is possible to go in increasing chip length might well yield some profitable results.

In charging wood to the digesters, some of the mills have used mechanical or steam packing to increase the charge. Many have found that any form of packing seems to interfere with circulation and to result in digester hang-ups.

Spent liquor is usually added to the digesters for the following reasons:

a) To dilute the white liquor which is usually made up stronger than required for cooking
b) To save the chemicals in the liquor without costly evaporation
c) To utilize the heat in the liquor
d) To aid in penetration

ENGLISH ECCO CLAYS TRADE MARK CLAYS

UNIFORM • SUPERIOR • DEPENDABLE

English China Clays Sales Corporation
551 Fifth Avenue, New York City

The volume of spent liquor used in various mills ranges from 10 to 50 per cent of the total liquor charge.

Normally 10 to 25 per cent of the chips are added, then spent liquor and finally white liquor, but there are variations of this procedure.

The cooking cycle normally consists of three stages: (1) the pressure raising and penetration period, (2) the full pressure period, (3) the pressure reducing period.

There are, of course, exceptions to this. In making hard stock for container board, it is not unusual to blow the digesters soon after full pressure is attained, and it is sometimes felt that any advantages gained by the time consumed in pressure reducing are more than offset by the loss of digester time.

There are a number of variables in the sulphate cooking process, all of which affects the final quality and yield of pulp. By manipulation of these variables, different types of pulp are produced. The important factors involved may be listed as follows:

1) Wood species, density, moisture
2) Uniformity of chip size
3) Ratio of chemical to wood
4) Concentration and composition of cooking liquors
5) Time to raise pressure.
6) Time at full pressure
7) Maximum temperature and pressure
8) Relief practice

The figures in Table 1 from Canadian mills will serve to illustrate different treatments of some of the variables mentioned.

Table 1

Type of Pulp Wood Used	(1) For Corrugating Board, Birch, Maple, Birch	(2) Bleachable Mixed Soft	(3) Liner Stock Mixed Soft	(4) Paper Stock Mixed Soft	(5) Hard Stock W. Hemlock, Sitka Spruce
Av. chip size	¾"	¾"	¾"	¾"	⅝"
Per cent Active Na_2O based on air dry wood	10.0	21.0	13.5	18.8	14.0
Cooking liquor — Lb. Na_2O per cu. ft.					
NaOH	3.50	2.58	3.50	4.63	4.20
Na_2S	2.78	1.16	2.78	1.83	1.60
Na_2CO_3	.64	.64	.64	1.10	1.00
Na_2SO_4	.36	.20	.36	.18	0.10
Lb. Na_2O/ton a.d. pulp.	420	830	516	750	565
Time to max. temp. hr..	2¾	2	1¾	2	1
Max. temp. deg. Fahr..	335	335	335	347	350
Time at max. temp. hr..	0	1¾	¾	1	½
Circulating system	None	1st 2 hrs.	None	Yes	None
Indirect heating	No	1st 2 hrs.	No	Yes	No
Direct heating	Yes	To blow	Yes	....	Yes
Volume spent liquor (per cent)	50	10	50	50	None

A Stain for the Identification of Bleached Sulphite and Bleached Kraft

F. W. STOCKER[1] and L. G. DURANT[2]

In the past our laboratory has experienced considerable difficulty with fiber analyses when attempting to differentiate between bleached kraft and bleached sulphite fibers.

Of the several stains introduced by Laughlin (Canadian Industries Limited, Report on Fibre Analysis Methods, June, 1938), the Y stain appeared to us to be the most promising for the differentiation of these fibers, but the results we obtained with it were not consistent. However, with this as a basis for further investigation, we attempted to devise a stain which would help us to clearly distinguish between bleached kraft and bleached sulphite fibers.

This paper deals with the preparation, use and potentialities of this stain.

Composition of Stain

Solution "A"

Basic Orange Stain

0.665 gram of duPont Basic Orange 3RN
55 ml. of distilled water
50 ml. of 95 per cent ethyl alcohol

The dye is dissolved in the water and then the alcohol is added.

Solution "B"

Dilute Hydrochloric Acid

Approximately 0.02 N hydrochloric acid.

(1) Assistant chemist, (2) research chemist, E. B. Eddy Company.

Solution "C"

Regular Hertzberg Iodine Stain

Dissolve 100 grams of zinc chloride C.P. (fused sticks) in 50 ml. of distilled water, and carefully adjust the specific gravity to 1.80 at 28 C. In preparing this solution, it is necessary to use the accuracy indicated.

To 25 ml. of distilled water, add 10.5 grams of potassum iodide, and 0.5 gram of iodine crystals. Add this solution to 80 ml. of the zinc chloride solution; stir well and allow to stand for twenty-four hours. To the supernatant liquid, add a crystal of iodine, and store the solution in a cool dark place.

Solution "D"

Chlorine Stain

50 gm. zinc chloride (fused sticks)
15 gm. calcium chloride (anhydrous)

Make up to a volume of 100 ml. with distilled water and add one-half ml. 0.02 N hydrochloric acid.

It is not advisable to keep the solutions used in preparing the new stain for a period exceeding two months.

Method of Use

Boil a representative sample of the unknown in acidified water (4 drops of concentrated hydrochloric acid to 50 ml. of distilled water) for about an hour. Decant acidified water and replace with distilled water, bring to a boil, then swirl around in a flask containing a few glass beads until sample is well dispersed. Dilute to proper consistency for mounting on slide. Prepare slide for analysis and cool to approximately 70 Fahr. This may be done quite easily by placing the slide on a glass plate partly immersed in a water bath, maintained at the desired temperature. The temperature of all stains when in use should likewise be in the neighborhood of 70 Fahr.

Add enough of solution "A" to cover the fiber (approximately ½ ml.), let stand for one minute, blot (*It is important that a clean filter paper, similar to Reeve Angel #230 be used for blotting in each case.*) with a clean filter paper. Rinse once with solution "B," and then blot dry.

Add enough of solution "C" to cover fibers (approximately ½ ml.), let stand 30 second, and blot.

Finally, add *one* drop of solution "D," immediately place cover glass in position on the slide, and leave for one minute while colors develop. The slide is then ready for microscopic examination.

Differentiation of the fibers is difficult after a period of thirty minutes as there is a definite fading of color.

No difference in shades were observed when pulps produced from various woods were examined.

Appendix

Various grades of the more common types of pulp have been examined in this laboratory. The colors obtained are listed below:

TYPE	GRADE	COLOR REACTION
Bleached Sulphite	High Alpha	Very pale blue, fades out to pale tan. Almost unstained
Bleached Sulphite	Postwar bleach; Approximately 90 G.E. Brightness	Very pale blue, fades out in 1-2 minutes to pale tan
Bleached Sulphite	Regular bleach; approximately 80 G.E. Brightness	Pale tan
Bleached Sulphite	Wartime bleach; Approximately 74 G.E. Brightness	Pale tan
Bleached Hardwood Sulphite	Dura Alba	Pale tan
Bleached Poplar Sulphite	Postwar bleach; approximately 80 G.E. Brightnes	Very pale tan
Unbleached Sulphite	.....	Medium to dark amber
Bleached Kraft	60	Medium blue
Bleached Kraft	45	Medium to dark blue
Bleached Kraft	Bleached Southern Kraft. Prewar bleach. Made in 1939	Medium to dark blue
Bleached Kraft	Tuftare. Prewar bleach. Made in 1934	Medium blue
Bleached Kraft	Alpha Fiber Solka No. 30. Approximately 80 G.E. Brightness	Pale to medium blue
Bleached Kraft	Alpha Fiber Solka No. 20. Approximately 70 G.E. Brightness	Dark blue grey
Semi-Bleached Kraft	Solka Duracel. Approximately 65 G.E. Brightness	Medium to dark blue
Semi-Bleached Kraft	Approximately 50 G.E. Brightness	Dark khaki to dark blue
Semi-Bleached Alpha Kraft	Solka No. 10-A. Approximately 40 G.E. Brightness	Dark khaki to dark blue
Unbleached Kraft	.....	Dirty grey to khahi, some blue
Bleached Straw	Manufactured in England. Alkali cook	Pale blue*
Unbleached Straw	Manufactured in England. Alkali cook	Very dark blue*
Bleached Eucalyptus	Manufactured in Australia. Kraft cook	Dark blue
Semi-Bleached Eucalyptus	Manufactured in Australia. Kraft cook	Khaki to very dark blue
Unbleached Eucalyptus	Australian manufacture. Kraft cook	Very dark blue, some khaki
Soda Pulp	Alkali cook	Very dark blue*
Groundwood	Unbleached	Yellow

(*) The characteristic appearance of these various fibers overcome any confusion arising from the fact that the colors observed for these pulps are similar to those for some kraft fibers.

ROOFING MACHINERY

MANUFACTURING CO.

Factory and Office

1130 W. Cornelia Ave., Chicago 13, Ill.

•

Designers and Builders of

Tar and Asphalt Saturators

Laminating Equipment

Embossing Units (brick siding, etc.)

Asphalt Coating Machinery

Looping, Drying and Cooling Systems

Winders for Roll Roofing

Shingle Cutting Machines

Wax and Lacquer Coating Machinery

•

We also manufacture cutting cylinders, anvil rolls, and squeeze rolls. We make a specially constructed steam jacketed 2" and 3" pump for handling viscous materials such as filled asphalt, heavy lubricating oils, and kindred products.

Pump catalogue upon request.

52 YEARS OF GROWTH and still looking ahead

Get a Good Start
And a Good Finish With
NORWOOD
WATER FILTERS AND
PAPER FINISHING MACHINERY

"Growing up with the paper industry" has been more than just a slogan at The Norwood Engineering Company. The original Norwood Calenders, Paper Finishing Machines and Water Filters were pioneers, leading the way which others have followed. Today, Norwood engineers are pioneering again in the field of postwar construction and equipment modernization.

You take no chances when you buy Norwood — for you are buying a complete engineering and fabricating service backed by more than a half century of experience with Paper Mill problems. Write for Filter Portfolio or Machinery Portfolio M.

P-1

The NORWOOD ENGINEERING COMPANY

16 N. MAPLE ST. FflorENCE, MASS.

Discussion

Two distinct colors are observed: the shade for acid cooked pulps ranging from a pale tan to amber, while the shade for alkaline pulps ranges from blue-khaki to a medium blue. The color developed on unbleached kraft lies on the borderline between that for acid and alkaline cooked fibers. The colors do not appear to be affected by the type of wood used in the cooking process. Such a condition makes possible the differentiation of bleached hardwood sulphite and bleached hardwood soda with this stain.

It has not been possible to examine the effect of this stain on either neutral cooked pulp or on magnesium or ammonia base sulphite pulps. Also we have not ascertained whether this stain is capable of differentiating between bleached and unbleached groundwood.

In evaluating this stain, standard furnishes of known composition containing various quantities of bleached kraft, bleached sulphite and soda pulp were prepared and analyzed using the procedure just described. The results obtained on these samples checked well with the known values for the mixtures analyzed. During the first few months that this stain was in use, our results on several occasions were erroneous. On investigating this, we observed that several factors were affecting our analyses.

Originally, it was our practice to wash the slide with distilled water after applying the acid. We found that, by blotting the acid off and not washing the slide, better results were obtained. In washing the slide, the acid which acts as a mordant and holds the basic orange stain on the fiber was removed. By eliminating the washing, the retention of the basic orange stain was increased. On the other hand, if the slides were not well blotted before the Hertzberg iodine stain was added, the excess acid tended to decompose the iodine stain. It was, therefore, obvious that the amount of acid was an important factor, since either too little or too much appeared to produce poor results.

The temperature of the solutions and the slide appeared to be an important factor. We found that above 80 Fahr., our results were not consistent, due to the rapid fading of color. Consequently, in our work we maintained slides and solutions at a temperature of 70-80 Fahr.

Since these changes were introduced we have experienced little trouble and have obtained excellent results. The stain has been in use in our laboratories for a little less than two years and, consequently, considerable work remains to be done. We would be pleased to receive comments from anyone who has an opportunity to experiment with this stain.

Investigation of T.S. (TAPPI) Permanganate Number

ROGER BOURGON
Control Superintendent
Consolidated Paper Corp., Ltd.

There has been frequent misunderstanding between members of different mills when discussing the bleachability of pulp due to the wide variety of test methods used in the industry. This was the case in the different mills of our company; each mill had a method with which they had been accustomed for a long time and which had served the purpose very well, but test results could only be compared after using a conversion factor which often created doubts. In order to promote uniformity, we decided that we should adopt throughout our corporation a standard method which should be suitable as a routine control test under ordinary mill operating conditions, and also one that is widely used throughout the industry.

An investigation made by Dr. John D. Rue and published in *Paper Trade Journal* of January, 1942, showed that the permanganate number is used by a number of the mills in the U.S.A., and therefore, should we adopt this method, we felt it possibly would be a step towards uniformity in the pulp industry. The permanganate number of a pulp, (T.S. Std. G-17; TAPPI Std. T 214-M) which is by definition "The number of millilitres of tenth normal potassium permanganate solution ($0.1NKMnO_4$) absorbed by one gram of moisture-free pulp under certain specified and carefully controlled conditions," was proposed, and before making any decision we investigated the suitablity of this method as a mill routine test, its accuracy in duplicating results and the possible causes of error due to reagents or devi-

ation from the specified standard procedure.

The reagents to be used were tested to find the stability of the titrated solutions over a reasonable period of time and the possibility of error due to impurities in the chemicals.

Investigations were made on the different parts of the tests to find the accuracy of the method and the tolerances that could be permitted as to temperature, time and quantities of reagents to be used.

The wet and dry methods of obtaining the test specimen were investigated and we found that the tests made from air dried hand sheets give more accurate results.

The moisture content of air dried pulp is determined quite easily and it is always possible to weigh the specimen to obtain one gram of moisture free pulp within the accepted tolerance.

The temperature of reaction has to be kept as close as possible to the set standard. A variation of 1 C. will change the results of 0.1 or more, according to the range of the test.

A number of tests were made to find the effect of reaction time on the results. A difference of 15 seconds will change the test by 0.1 permanganate number.

The standard procedure calls for the addition of 4N-H_2SO_4 immediately before adding the N/10 $KMnO_4$ and although the effect is slow, long standing will give high results.

The addition of $H2SO_4$ after the $KMnO_4$ has been added will change the results completely. In one case, the sulphuric acid was added 10 seconds after the permanganate and a reading of 16.7 was obtained for a pulp of a permanganate number of 18.6.

For permanganate numbers not higher than 20, the standard calls for the use of 25 ml. of N/10 $KMnO_4$ and for the pulp of higher lignin content, 40 ml. of N/10 $KMnO_4$ should be taken. It is obvious that for the same pulp, the increase in the quantity of permanganate will result in higher readings and the tester should always start the test on the basis of 25 ml. of N/10-$KMnO_4$.

A number of duplicate tests were made on samples of pulp to check the precision of the method. The same pulp will always show readings within limits of experimental error when the test is made with proper accuracy.

Although the method is simple and easy to perform, accuracy is needed in carrying out the test and no point should be neglected. Nevertheless, the precision demanded by the standard offers no difficulty for the operator and it can easily be performed by any tester on routine work. Some of our testers who have had no previous knowledge of the method were able to make the test with accuracy after four or five trials. The reagents needed are easily kept standard and offer no difficulty in their preparation. The equipment required for the test is standard laboratory apparatus and no delicate mounting is necessary. The facility with which the tests can be duplicated shows the precision of the method and eliminates the doubt created by human factor unavoidable in some other tests.

The test is made in a short time and the results can be reported some 45 minutes after a digester has been blown and give the cooks an idea of what is to be done on the next blow.

We have already adopted the permanganate method as a mill standard on routine work and we find same very satisfactory.

Recovery of Waste Heat With Heat Pumps

C. E. SIMPSON
Consulting Engineer

All industries employing some sort of condensing and evaporating process may expect considerable economic benefit from heat pumps in the form of thermo-compressors. A thermo-compressor is a heat pump operating without a special carrier fluid, and consequently without exchanger surfaces, because it compresses the steam coming from an evaporating pan or tank directly to a higher and useful potential. This steam is then returned through the liquid to be evaporated, where it gives off its heat to the point of the liquid temperature. After that, it may be used in the conventional way to preheat the incoming new liquid, and returned as condensate to the boiler.

In paper mills, where large quantities of water are evaporated, contamination with chemicals of the resulting steam is often a problem. But there is nothing insoluable about that sort of thing. It merely has to be investigated, and means that general statements about the possibility of thermo-compressors in paper mills cannot be made until the situation in the mill in question has been determined. The heat economy of the heat pump is, however, not affected by the necessity or otherwise of installing auxiliaries, and is always favorable.

It is, unfortunately, not feasible to describe to you a model evaporator plant for a paper mill, because, in heat pumps, there is no such thing as a model plant. All single factors affecting the operation of a heat pump affect all others to a varying degree. It is highly improbable that two plants are sufficiently alike in every detail to permit the identical alignment of elements in a heat pump all the way through. There is nothing wrong with this at all; on the contrary, it testifies to the complete adaptability of heat pumps to any given set of conditions. It merely means that experience and ingenuity of the design engineer must be trusted to a greater extent than our plant executives have been accustomed to doing.

While it is a certainty that improvements can be effected in the evaporator system of any paper plant, this is not necessarily so on digesters. In some plants, too much auxiliary equipment might be needed, in other heat recovery is at present carried on to such a degree that the additional few per cent improvement would not justify the expenditure. Other mills again would benefit to a considerable extent from investigation of heat pump possibilities. It is, however, certain that the economy of a new plant will be improved by designing a heat pump into the digester aggregate in the first place. The difficulties to be overcome in the case of existing mills are due only to the fact that too many changes may have to be made in the existing equipment Where that is not required, a heat pump is necessarily useful.

The recovery of heat from black liquor, wash water and so on by means of heat pumps presents no technical problem at all. The economy of doing so depends largely on individual conditions again, but it is possible here to get down to averages in a loose way. It can within narrow limits be demonstrated that savings of about $80.00 per annum per ton of plant capacity may be made with an investment, at prewar cost levels, of $150.00 per ton capacity, based on steam cost of $0.40 per 1000 lb. at the boiler and a working year of 310 days.

Curiously enough, the first attempt to employ a heat pump in paper mill was not made on either evaporators or digesters, which would have been the logical point of first attack, nor even on waste liquors, but on recovery of heat from hot air rejected by dryers. While the process as such was considerably advanced by the data gathered, this particular application was not eminently successful. The reason is partly that air is not the best medium in the world to run heat engines on, and partly that turbo-compressors were not at that time in the field. Another attempt at heat pump operation made not so long ago in an Ontario mill failed because it

OVERHEAD CRANES

¼ Ton "American" 17' Span
1-Ton Curtis 24' Span
1½-Ton P&H 28' & 34' Span
3-Ton "Detroit" 28' Span
5-Ton Shephard Niles 18' Span
5-Ton Euclid 38'8¾" Span
5-Ton Shephard Niles 40' Span
5-Ton Shaw 82' Span
5-Ton "American" 70' Span
5-Ton "American" 47'5" Span
5-Ton Manning Maxwell Moore 31' Span
5-Ton Case Gilbert 44'9¾" Span
5-Ton P&H 44'9¾" Span
5-Ton Champion 44'8¾" Span
5-Ton Bedford 24' Span
6-Ton P&H 78' Span
6-7-Ton Milwaukee 70' Span
6-Ton "American" 77' Span
7½-Ton P&H 30'6" Span
7½-Ton Lakeside 100' Span
7½-Ton Bucyrus-Erie 70' Span
10-Ton P&H 80' Span
10-Ton Milwaukee 58'8"
10-Ton Morgan 38'5" Span
10-Ton Alliance 38'9" Span
10-Ton Erie 80' Span
10-Ton Ensco 80' Span
10-Ton P&H 78' Span
10-Ton Bedford 78' Span
10-Ton "American" 27' Span
15-Ton Whiting 57'9" Span
15-Ton Leonard-Burke 74'9" Span
15-Ton Shaw 77' Span
15-Ton Shaw 82' Span
15-Ton Whiting 74'8" Span
15-Ton Niles 32' Span
15-Ton Chesapeake 35'8" Span
15-Ton Alliance 35' Span
15-Ton Northern 53' Span
20-Ton Alliance 77' Span
20-Ton P&H 81'4" Span
20-Ton Shephard Niles 44'9" Span
20-Ton P&H 50' Span
20-Ton Whiting 80' Span
20-Ton P&H 51'4" Span
25-Ton P&H 74'8" Span
25-Ton Leonard Burke 74'8" Span
25-Ton Whiting 82' Span
25-Ton Niles 40' Span
25-Ton Shaw 70' Span
25-Ton Cleveland 106' Span
30-Ton Morgan 39' Span
30-Ton Niles 53'9" Span
30-Ton Whiting 60' Span
35-Ton Northern 22' Span
75-Ton Alliance 90' Span
75-Ton Alliance 37' Span
80-Ton "American" 40'8" Span
150-Ton Whiting
200-Ton Alliance 100' Span

Take advantage of the ECONOMY service by telephoning to us COLLECT, which will enable us to discuss your requirements and present our suggestions.

In addition to overhead cranes we can supply all types of shovels, cranes, draglines, tractors, or practically everything in the construction equipment field. May we have your inquiries?

ECONOMY CO., Inc.

49 Vanderbilt Avenue, New York 17, N. Y.

Telephones: MUrrayhill 4-2294, 4-2883, 4-2295, 4-2844, 4-2296, 4-8252

RYERSON STEEL

IN STOCK for prompt shipment—Call

your nearest Ryerson dealer.

Partial list of Ryerson products:

Alloy Steels	Boiler Fittings	Threaded Rods
Bars—Shapes	Reinforcing	Rivets—Nuts
Structurals	Floor Plate	Chain—Wire
Rails—Plates	Tool Steel	Tubing
Sheets—Strip		
Shafting—Bolts		
Stainless		

Large stocks in a complete range of sizes and analyses. Write for a current Ryerson Stock List.

Ryertex Bearings Laminated Plastic

Ideal for suction box covers, suction pipe covers, forming boards, doctor blades, and all types of water, oil or grease lubricated bearings. Write for details on any specific bearing application.

Joseph T. Ryerson & Son, Inc., Steel-Service Plants: Chicago, Milwaukee, Detroit, St. Louis, Cincinnati, Cleveland, Pittsburgh, Philadelphia, Buffalo, New York, Boston.

was carried out with insufficient means, namely, a compressor of the wrong type and size.

Of the four points of incidence of heat pumps operation in a paper mill, I have mentioned, namely: (1) Evaporators, (2) Digesters, (3) Waste liquors, and (4) Dryers. The dryers come last in order from every possible point of view. There are many other things to be done to improve heat economy on dryers before we start on heat pumps, and concentration on the other and better suited parts of the process sequence would seem to pay higher dividends at the present.

While heat pumps are only one of many devices designed to improve heat economy, they do, if correctly applied, give the best performance both where the use of primary energy and operating expense is concerned. Against that stands the relatively high first cost, dollar for dollar, in comparison to other heat conserving equipment. As we have seen, however, this is soon offset by a substantially higher degree of effectiveness.

The fact that there are at this time no representative heat pump installations in Canada to which I might refer you is, in my opinion, not so much due to disinclination to look at anything new, as has been suggested, but rather to absence of accurate information, and where that was available, to the well-known tendency to let the other fellow try it first. The trouble with that, so far as Canadian paper is concerned, is that the other fellow may well be in Sweden or Finland, and I, for one, am not too certain that he is not already trying it.

Efficiency in paper mills is tied up with heat more than with any other single item, and consequenly the heat situation should be a matter of record in terms of facts and figures. With that much to start on, the position of heat pumps in any given plant is soon determined.

A Review of the Literature on the Sulphite Process, 1943—Aug., 1945

G. J. C. POTTER
Pulp and Paper Research Institute of Canada

McGovern and McGregor (23) in a consideration of current pulp shortage suggest that this may be lessened by decreasing fibre losses in chipping, pulp screening, washing and bleaching operations, by utilizing available but little-used pulpwood species and by modifying certain variables of the cooking process. In connection with this, they give tabulated data on the density and chemical composition, as well as on the sulphite pulp yields and pulping characteritsics of common and less-common pulpwoods, both softwoods and hardwoods; they also include a chart showing the variables affecting the cooking process. Edwardes (6) in a survey of the pulp situation, both prewar and postwar, points out the decided trend in the U.S.A. towards consumption of bleached pulps, the consumption of bleached sulphite having trebled during the period between the two wars. There is every indication that this trend will continue in the postwar period. The principal future outlet for sulphite pulp seems to be in newsprint and special groundwood papers for unbleached, and in special dissolving pulps for bleached grades. On the other hand, bleached groundwood may have a marked effect on bleached sulphite requirements for printing papers.

Du Bois (4), comparing the sulphite industry in the U.S.A. and in Canada, observes that in the U.S.A., due to limitations of wood supply, there will be a tendency to use semi-chemical processes giving high yields, because of the range of woods that can be used and the special pulp properties obtainable; in some cases, there may be changes to magnesia base and besides, operation in parallel with other cooking processes. In Canada, wood supply is still adequate for expansion, and power requirements and markets are favorable. Technical progress must be kept up, especially in the line of control, since the best index to pulp quality for paper making is still the pulp behavior on the paper machine. The use of statistical data is strongly recommended as an aid to operation control.

Hagglund (12), in an examination of the effect of the properties of Swedish woods on the yield and quality of sulphite pulp, found that top wood gave a 2% lower pulp yield than root wood, that the heartwood gave a higher tear and burst than the sapwood, that the pulp yield was

largest for the comparatively rapidly grown wood from southern Sweden, that the strongest pulp was obtained from the comparatively dense wood of northern Sweden and that variation in the yield and quality of the pulp was independent of the density. Ostrowski (27) shows that sulphite pulp of higher burst is obtained from balsam than from spruce, increases in burst being obtained from seasoned wood while tearing strength for the two species is varied. The mill practice of selecting the larger and cleaner wood, and the balsam, out of the regular mill wood improves the cleanliness, strength and brightness of the resulting sulphite pulp. While higher yields are obtained from spruce, under identical cooking conditions there is little difference in the permanganate numbers of the pulps from the two woods. At high or low permanganate numbers, the beater strengths of balsam pulps were more favorable, burst averaging 24% higher and fold 55% higher than spruce pulps.

According to Johansson (16), branches of the wood affect the quality and strength of the sulphite pulp from it. Hopner (14) finds that wood previously soaked in water gives more uniform and brighter pulp with higher breaking length and fold than air-dry wood. The lack of uniformity in pulps from air-dry chips may be due to fluctuation in wood extractives, chip size, moisture content and poor circulation, whilst with soaked chips moisture variations disappear and circulation is generally improved. Moore and Yorston (25) review the literature dealing with the effect of wood on pulp quality and the penetration of acid into wood. From this review, they conclude that forcing liquor into the wood before cooking will shorten the cooking cycle, give more uniform pulps and may bring about increases in pulp strength. This operation not yet having reached mill scale, they suggest as alternatives in particular cases elimination of over-length or thick chips, rapid rise to a temperature not exceeding 100 C. anywhere in the digester, strong liquor and early build-up of pressure.

McGovern and Keller (22), comparing southern hardwood pulps with birch and aspen for rayon pulp, show that the former have the same alpha-cellulose content, lower pentosan and lower ether-soluble contents than the latter. Cottonwood and black willow gave the same yields as aspen and higher yields than birch though birch had the greatest strength. In cooking southern hardwoods, increase in pulping time caused decrease in yield, lignin and pentosan content and increase in cellulose, alpha-cellulose, burst, tear and solid fraction. In the Everett mill of the Weyerhauser Timber Co., it is estimated that the combination of hydraulic log barking and a new chipper has increased pulp production by 20% per 1000 ft. of logs (1). Wurz and Swoboda (37) find that small chip size does not increase fiber fragments.

According to L'Orange and Kittelsen (19) the formation of calcium sulphate in acid making can be reduced 60% by installing a pyrometer in the combustion chamber to control temperature. Karlberg (17) refers to the patents of Grewin and Karlberg concerning the arrangement of a "free-acid" section in the bottom part of the ordinary tower, whereby the acid can be strengthened to more than 90% of the maximum solubility of sulphur dioxide even at fairly high water temperatures. Terling (33) points out that acid-proof tiles with plain edges give a brickwork for the towers as stable as grooved and tongued tiles and facilitate replacements during repairs, while spiral setting shortens the working time and decreases the cutting of tiles for adjustments. Interesting developments can be expected from sealing the concrete shell with acidproof black pitch. Lundberg (20) has made a very comprehensive study of acid making and recovery systems which will soon be published in book form. This study is illustrated by numerous tables, calculations and graphs, theoretical as well as practical considerations being taken. The use of a single blow pit for all digesters is advocated as costing less to install and simplifying the design and operation of the recovery system.

The advantages of a sulphur spray burner over a rotary burner are given by Murchie (26) as (a) simplicity of operation; (b) 18% sulphur dioxide can be maintained for operation; (c) free sulphur content of acid does not exceed 0.004% and averages 0.0002%; (d) an average sulphur trioxide content of 0.020%; (e) lime formed in the digester contains only 6% calcium sulphate and is easily removed by shaking; (f) loss of sulphur fed to the burners amounts to 1.35% instead of 2.5%; and (g) steam savings are effected by the higher raw acid temperature obtained. Erickson (10) shows how filtration of the sulphite acid improves pulp quality and the uniformity of pulp strength characteristics.

Eidem (9) discusses cooking acid for fodder cellulose and other very soft sulphite pulps. He applies published data on the lime-sulphur dioxide-water system to hot acid systems and recommends the possible development of hot-pressure acid systems by the application of the laws of physical chemistry to practical operations. Schur and Baker (30) compare calcium-base, sodium-base and mixed calcium and sodium-base cooking liquors in pulping red spruce and balsam. For a given degree of cooking, determined by the permanganate number, the following findings were made: (1) Sodium-base liquor requires a shorter time than calcium-base liquor. (2) Slightly higher yields are obtained with sodium-base than with calcium-base liquor, the difference in pulp yield depending on species and the degree of cooking. (3) Pentosan and viscosity determinations indicated less degrading action on pulp with sodium-base than with calcium-base liquor. (4) Sodium-base liquor developed higher burst and power tear in the same beating time than calcium-base liquor. A further communication (31) by Schur and Ingalls showed that the differences in the rates of pulping by the two acids decreased slightly when the time to reach maximum temperature was reduced, while fiber liberation, as judged by freedom from screenings, decreased much more rapidly in the case of calcium-base liquor. No "burning" of chips by either acid was noticed when maximum temperature was reached in as short a time as 1½ hrs. and total cooking time was 4½ hrs. Kobe and Hanson (18) find that the strength properties of hemlock pulp prepared by the sodium sulphite pulping process are improved by the addition of sodium thiosulphate.

McMasters (24) has investigated the Palmrose Iodate and the Winkler methods of testing cooking liquor and concluded that the iodate method is sufficiently accurate in control work to assure the production of uniform cooking acid throughout the mill. Du Rietz and Landqvist (5) recommend an alkaline peroxide titration method in which the use of iodine is avoided and standard sodium hydroxide solution is used for titration. Samuelson (29) gives a method for the determination of lime in cooking liquor in 20 to 30 minutes and with an error of 0.5% Titration is affected with sodium hydroxide alone by replacement of sulphur dioxide with hydrochloric acid and displacement of metal cations by hydrogen ions. The method can also be used for analyzing sodium bisulphite solutions. By the method of Eftring (8) the lime content can be determined in 2 minutes by removing sulphur dioxide with air and then titrating with iodine and starch.

Jayme and Lochmuller-Kerler (15) on cooking beechwood by the sulphite process at temperatures not above 105 C. and then bleaching the resulting product with

D&T
MICROMETERS
SNAP GAGES &
SPECIAL TOOLS
Bow and bar type micrometers with sliding mandrels that give you 6 in. of range with 3 standards. Capacities: 0 to 6 thru. 162 to 168.
Interchangeable Anvil Micrometers with 3 setting standards insure 6 in. of measuring accuracy.
Snap Gages—Rigid construction accuracy from 3 in. upward.
Tubular frames are of highest quality welded construction. Micrometer heads produced by nationally recognized manufacturer.
DAVIS & THOMPSON CO.
MFRS. OF MACHINE TOOLS & MICROMETERS
MILWAUKEE WISCONSIN

CAMACHINE 15
WINDER
FOR PAPER AND PAPER BOARD
Produces clean-cut rolls of controlled density, as hard or as soft as you like. Speeds up to 2000 f.p.m. on paper, and 1000 f.p.m. on paper board. Roll diameters up to 42". Built in widths of 53" to 92". A minimum strip width of 2", with special slitter attachment.
There's a CAMACHINE for YOU!
WRITE FOR DETAILS
CAMERON MACHINE COMPANY
61 POPLAR STREET, BROOKLYN 2, N. Y.
MIDWEST OFFICE. 111 W. MONROE ST., CHICAGO 3, ILL.

sodium chlorite obtain a pulp of high whiteness with a yield of 70%; this pulp on beating to 47° S.R. attained a breaking length of 5088 metres but had a folding endurance of only 12 double folds. Holzer (13) shows that, if the working pressures of digester shells were made greater, increased digester pressures with consequent higher increase in free sulphur dioxide would give greater flexibility of operation; among other advantages, over present operating procedure, production could be increased without any rise of temperature or maintained with a lowering of temperature and a softer pulp could be obtained at the same temperature and production rate. Tomlinson (34) gives two flow diagrams showing the equipment for the magnesium bisulphite cooking process and the heat and chemical balance for a 100-ton mill. He also points out that this cyclic process does not preclude recovery of by-products. Ulfsparre (35) adjudges from experimental work that the same result can be obtained by increasing the velocity of the cooking reaction either through a decrease in lime content or through an increase in temperature.

Malik (21) finds that tight chip packing combined with forced circulation will increase the yield per cubic meter of digester space from 85 kg. pulp for direct cooking to 100 kg. and reduce steam consumption from 2 kg. to 1.5 kg. per kg. pulp. Edwardes (7) cites the advantages of proper chip distribution, forced circulation and indirect heating. They may be enumerated as follows: (a) a very appreciable increase in production for the same cooking time; (b) a 35% reduction in cooking time; (c) marked reduction in tailings; (d) better uniformity of pulp within the digester; (e) improvement in strength and color; (f) decrease in lime and sulphur consumption; (g) 5% increase in yield; (h) increased concentration of waste liquor. Foster (11) considers forced circulation essential for obtaining uniform pulp. To retain the benefits of the hot-acid system, direct heating can be coupled with forced circulation by mixing steam with the acid outside the digester in a special mixer or hydroheater by means of which automatic control of the digester is attained. By this arrangement there is a great saving in steam.

Caulfield, Jenness and Nystrom (3), in a study of heat transfer of water, 30% caustic soda solution, soda black liquor and sulphite liquor in an indirectly heated digester, suggest that commercial heaters may be operating in the undesirable range of minimum heat conductance. Swartz (32) describes the Rosenblad-Tomlinson-Hellstrom system (Canadian Patent No. 382,818) by which the heat and SO_2 from the blow are recovered in two stages; the steam from the blow is condensed in a jet condenser and the sulphur dioxide passes on to a separate accumulator system and used in the makeup water for the Jenssen towers. Actual operating figures for a 10.7 ton digester show by this system a recovery of about 13,000 lb. of steam and 350 lb. of sulphur per blow. By the use of a circulating blow tank and vacuum washers Penney and Ostrowski (22) note the following advantages: (a) saving in building costs with resultant lower maintenance cost; (b) reduction in operating costs; (c) improvement in color, dirt and strength of pulp; (d) improved recovery of waste liquor for utilization purposes.

Brauns (2) reviews various Swedish developments including liquor removal from the digester and addition of waste liquor to fresh cooking liquor. The cooking experiments of Wultsch (36) show that temperature is more critical in determining the chain length of the cellulose liberated during the cook than the composition of the cooking liquor or the time of digestion, while there appears to be a relationship between the hemicellulose content of the pulp and its degree of polymerization at various stages of the cook. Wurz and Swoboda (38) find that the greatest amounts of carbon dioxide are generated at the beginning and towards the end of the cook

References

1. Anon. Biggest chipper in world at Weyerhauser mill makes possible greater pulp yield from wood. *Pacific Pulp Paper Ind.* 18, no. 7: 20 (July, 1944). *B.I.P.C.* 14: 404. See also *Pulp & Paper Manual of Canada*, 1945.

2. Brauns, O. Technical notes. *Svensk Papperstidn.* 46, no. 11: 244-253; no. 12: 271-280 (June 15, June 30, 1943). Condensed Translations *C.P.P.A.* 8, no. 2: 38-46 (March, 1945). *B.I.P.C.* 14: 62.

3. Caulfield, J. G. L., Jenness, L. C., and Nystrom, G. L. Heat transfer characteristics of an indirectly-heated digester. *Paper Trade J.* 115, no. 23: 25-29 (Dec. 2, 1942). *B.I.P.C.* 13: 141 *C.A.* 37: 1265.

4. DuBois, A. H. The future of the sulphite industry in Canada and the U.S.A. *Pulp Paper Mag. Canada* 46, no. 3: 153-154, 156 (6th Wartime Issue, 1945). *B.I.P.C.* 15: 289.

5. Du Rietz, C., and Landqvist, N. The titration of the sulphite cooking acid. *Svensk Papperstidn.* 47, no. 19: 457-462 (Oct. 15, 1944). *B.I.P.C.* 15: 200.

6. Edwardes, Vance P. Chemical pulps look ahead. *TAPPI Bull.* No. 31 (May 12, 1944). *Worlds Paper Trade Rev.* 122 no. 12: 659-660, 696 (Sept. 23, 1944).

7. Edwardes, Vance P. Indirect vs. direct sulphite cooking. *Pulp Paper Mag. Canada* 45, no. 12: 891-892 (Nov., 1944). *B.I.P.C.* 15: 161.

8. Eftring, E. The determination of calcium bisulphite in the cooking acid; a new method. *Svensk Papperstidn.* 48, no. 11: 265-274 (June 15, 1945). *B.I.P.C.* 15: 448.

9. Eidem, I. Hints for the preparation of the cooking acid for the manufacture of fodder cellulose. *Svensk Papperstidn.* 45, no. 12: 239-247 (June 30, 1942). *B.I.P.C.* 13: 77.

10. Erickson, Arthur E. Filtration of sulphite acid. Paper Ind. and P. World 26, no. 6: 729 (Sept., 1944). *B.I.P.C.* 15: 41.

11. Foster, J. Uniformity in sulphite pulping. *Pulp Paper Mag. Canada* 46, no. 3: 249-254, (6th Wartime Issue, 1945). *B.I.P.C.* 15: 303.

12. Hagglund, E. The influence of wood quality upon yield and quality of sulphite pulp. Iva no. 2: 77-84 (May 12, 1942). *Svensk Papperstidn.* 45, no. 14: 286 (July 31, 1942). *B.I.P.C.* 13: 173. *C.A.* 37: 765.

13. Holzer, W. F. Limits of effect of acid concentration—digester pressure relation in sulphite pulping. *Tech. Assoc. Papers* 27: 276-279; discussion 95-97 (June, 1944). *Paper Trade J.* 118, no. 16: 35-38 (April 20, 1944). Paper Ind. and P. World 26, no. 3: 274, 277-278, 280 (June, 1944). *Pacific Pulp Paper Ind.* 18, no. 4: 34-36 (April, 1944). *B.I.P.C.* 14: 300. *C.A.* 38: 3469.

14. Hopner, Th. Effect of moisture content of wood on the sulphite digestion of spruce. *Cellulosechemie* 21: 97-108 (1943). *C.A.* 38: 5401. *B.I.P.C.* 15: 33.

15. Jayme, G., and Lochmüller-Kerler, E. Relation between hemi-cellulose content and strength properties of pulps from beechwood. Holz als Roh.-u. Werkstoff 5, no. 11: 377-381 (Nov., 1942). Condensed Translations *C.P.P.A.* 7, no. 4: 81 (Nov., 1944).

16. Johansson, D. Estimation of the quantity of branches in wood and their effect on values of sulphite pulp therefrom. Holz als Roh.-u. Werkstoff 6: 45-50 (1943). *Chem. Zentr.* II: 1608 (1943). *C.A.* 38: 6092.

17. Karlberg, R. Concerning a free-acid tower and similar installations in acid making. *Svensk Papperstidn.* 46, no. 1: 3-14 (Jan. 15, 1943). *Condensed Translations* 7, no. 1: 1621 (Jan., 1944). *B.I.P.C.* 13: 461. *C.A.* 37: 5234.

18. Kobe, K. A., and Hanson, J. M. The effect of sodium thiosulphate in the sodium sulphite pulping process. *Paper Trade J.* 117, no. 2: 25-26 (July 8, 1943). *B.I.P.C.* 13: 492.

19. L'Orange, G., and Kittelsen, Fr. Formation of calcium sulphate during acid making. *Papir-J.* 45, no. 6: 114 (March 31, 1942). *B.I.P.C.* 13: 177. *C.A.* 37: 1038.

20. Lunaberg, A. H. Acid making in the sulphite pulp industry. *Pacific Pulp Paper Ind.* 17, no. 1: 18-27; no. 2: 27-31, 33, 35, 37, 39-40; no. 3: 30-31, 33, 35-36, 39, 41, 43; no. 4: 32-37; no. 6, 26, 28, 30-31, 33, 35, 37-38; no. 7: 32, 34-35, 37-38, 40, 43-44; no. 8: 37-38, 41, 43, 45-46; no. 9: 40, 43-44; no. 10, 37-38, 40, 42, 45-46; no. 11: 36, 39, 41-42, 45-46; no. 12: 32-35, 37-38 (Jan., April, June-Dec., 1943); 18, no. 1: 36-37, 39-40; no. 3: 24, 26, 29; no. 4: 48, 51; no. 6: 48, 51, 53; no. 7: 29-31; no. 8: 40, 42, 44 (Jan., March, April, June-Aug., 1944); 19, no. 3: 42, 44, 46-47; no. 6: 51-52; no. 7: 51-52, 54, 56, 59-60; no. 8: 69-71 (March, June-Aug., 1945).

21. Malik, A. Heat technology in sulphite mills. *Wochbl. Papierfabr.* 73, no. 7: 105-106 (April 4, 1942). *Svensk Papperstidn.* 45, no. 13: 271 (July 15, 1942). *B.I.P.C.* 13: 212. *C.A.* 37: 1038.

22. McGovern, J. N., and Keller, E. L. Sulphite pulps from several southern hardwoods. *Southern Pulp Paper J.* 5, no. 11: 7-10 (April, 1943). *B.I.P.C.* 13: 354. *C.A.* 37: 3265.

23. McGovern, J. N., and McGregor, G. H. Some factors affecting sulphite pulp production. *Pacific Pulp Paper Ind.* 17, no. 10: 13-14 (Oct., 1943). *Paper Trade J.* 117, no. 27: 28-34 (Dec. 30, 1943). Paper Ind. and P. World 25, no. 9: 1030-1036 (Dec., 1943). *Pulp Paper Mag. Canada* 15, no. 2: 74-81 (Feb., 1944). *B.I.P.C.* 14: 125. *C.A.* 38: 1357.

24. McMasters, D. R. Sulphite acid testing. *Paper Trade J.* 117, no. 2: 30-35 (July 8, 1943). *B.I.P.C.* 13: 267. *C.A.* 37: 6128.

25. Moore, T. R., and Yorston, F. H. Wood properties in relation to sulphite pulping. *Pulp Paper Mag. Canada* 46, no. 3: 161-164 (6th Wartime Issue, 1945). *B.I.P.C.* 15: 293. *C.A.* 39: 3198.

26. Murchie, R. B. Sulphur spray burner operation. *Pulp Paper Mag. Canada* 45, no. 12: 957-958 (Dec., 1944). *B.I.P.C.* 15: 209.

27. Ostrowski, H. J. Wood influence on pulp quality. *Pulp Paper Mag. Canada* 44, no. 11: 807-809 (Oct., 1943). *B.I.P.C.* 14: 126. *C.A.* 38: 1358.

28. Penney, G., and Ostrowski, H. J. New developments in sulphite pulp preparation. *Pulp Paper Mag. Canada* 45, no. 3: 149-152 (Feb., 1944). *B.I.P.C.* 14: 259. *C.A.* 38: 2202.

29. Samuelson, O. The determination of the total lime content in the sulphite cooking acid. *Svensk Papperstidn.* 48, no. 3: 55-56 (Feb. 15, 1945). *B.I.P.C.* 15: 367.

30. Schur, M. O., and Baker, R. E. A further comparison of sodium- and calcium-base sulphite acids. *Paper Trade J.* 115, no. 12: 33-40 (Sept. 17, 1942). *Tech. Assoc. Papers* 25: 453-460 (1942). *B.I.P.C.* 13: 78.

31. Schur, M. O., and Ingalls, E. G. A further comparison of sodium- and calcium-base sulphite acids. II. The effect of decreasing the time to maximum temperature with a corresponding reduction in total cooking time. *Tech. Assoc. Papers* 26: 296-300 (1943). *Paper Trade J.* 117, no. 12: 34-38 (Sept. 16, 1943). Paper Ind. and P. World 25, no. 4: 438 (July, 1943). *B.I.P.C.* 14: 67. *C.A.* 37: 6454.

32. Swartz, J. N. Sulphite blow heat and gas recovery. *Pulp Paper Mag. Canada* 44 no. 2: 139-142 (Wartime Service Issue, 1943). *B.I.P.C.* 13: 335. *C.A.* 37: 2173.

33. Terling, V. Brick lining of acid towers. *Svensk Papperstidn.* 46, no. 3: 51-54 (Feb. 15, 1943). *B.I.P.C.* 13: 461. *C.A.* 37: 5234.

34. Tomlinson, G. H. The magnesium bisulphite cooking process. *Pulp Paper Mag. Canada* 45, no. 11: 817-820 (Oct., 1944). *B.I.P.C.* 15: 145. *C.A.* 39: 187.

35. Ulfsparre, S. Chemistry of sulphite cellulose cooking. "The Svedberg" Memorial Volume, 379-399 (1944). *B.I.P.C.* 15: 260. *C.A.* 39: 1289.

36. Wultsch, F. The decrease in degree of polymerization of cellulose and the changes in the chemical composition of the pulp during the sulphite cook. *Papier-Fabr. Wochbl. Papier-fab.* No. 4: 128-131 (April, 1944). *B.I.P.C.* 15: 261. *C.A.* 39: 1757.

37. Wurz, O., and Swoboda, O. Fibrous fragments in sulphite pulp. *Papier-Fabr.* 40, no. 5/6: 22-24 (Feb. 7, 1942). *Svensk Papperstidn.* 45, no. 10: 207 (May 31, 1942). *B.I.P.C.* 13: 202. *C.A.* 37: 1038.

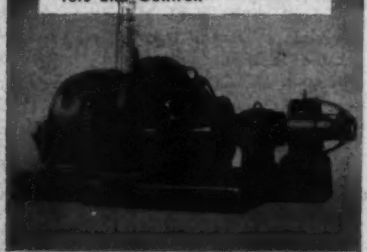
38. Wurz, O., and Swoboda, O. The carbon dioxide content of sulphite digester relief gases. *Papier-Fabr.—Wochbl. Papierfabr.* No. 2: 48-51 (1944). *B.I.P.C.* 15: 304. *C.A.* 39: 1757.

GUARANTEED
POWER EQUIPMENT

A Complete Service in Either Rebuilt or New

REBUILDERS OF . . . A.C. and D.C. Motors, Generators, M-G Sets, Pumps, Control Equipment, Transformers, Switchboards, Alternators.

DISTRIBUTORS OF . . . Rockwood Drives and Bases, Falk Couplings, Modern Motor Drives, General Electric Motors and Control.



CHICAGO ELECTRIC CO.
1313 West 22nd Street
Chicago 8, Illinois

Problems of Storing Coal

M. O. NEILSON
Consulting Engineer
Champion Paper Mills Ltd.

In 1943 the Heat and Power Committee prepared and submitted to the mills of the Association, a questionnaire on storage of coal, the principal purpose of which was to collect and correlate their experience with and prevention of fires in their coal piles.

The questionnaire sent to the mills contained sixteen questions, the first 12 of which touched on the most pertinent factors in the handling and storing of coal. The remaining questions covered means used to protect the coal against catching fire; experience with fire; means used to extinguished fire and finally the ascribed causes of fires.

The first question asked was what grades of coal the mill used and stored. Of the 50 mills replying, 29 or 58% appeared to use slack coal only; while 11 or 22% used nut and slack only. Of the remaining 10 mills, 4 used prepared coal only while the balance used a combination of nut, prepared and powdered fuel (—¼").

To the next question, as to whether different grades are stored in one or two piles, 34 mills or 68% replied that only one grade is used, while of the remaining 16 mills, 9 or 18% store different grades separately and 5 or 10% store different grades in the same pile. Of these 5 mills 4 had had troubles with fire.

The third question which concerned the tonnage of coal stored showed that

Kalamazoo GLAZED TILE

—the finest material for Paper Mill needs

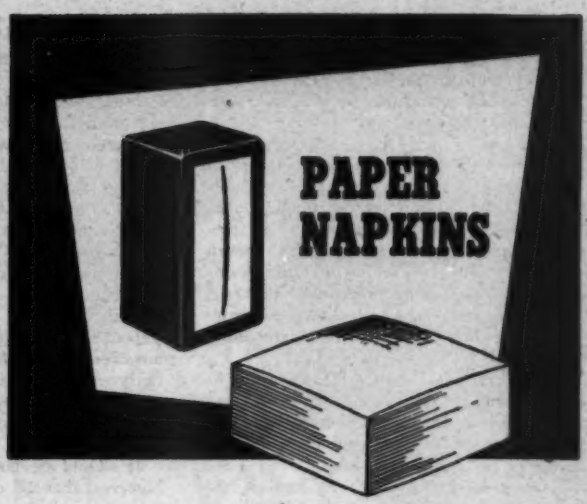
Hundreds of paper mill executives and engineers know that Kalamazoo Tile construction costs less—lasts longer—controls stock better—requires less maintenance—and is more flexible as to size or design in meeting production layouts.

No other material equals the smooth, hard surface that is impervious to most chemicals—flushes clean—does not flake, pit or scale—and is free from friction.

Should fins—mid-feathers agitators—round—square or tapered ends, corners and bottoms be needed—the exclusive Kalamazoo method makes it easy to construct and moderate in cost, usually less than reinforced concrete.

ASK for ENGINEERING DATA

Kalamazoo TANK & SILO CO
KALAMAZOO - MICHIGAN



ANY fold desired. Plain, embossed or printed—our machines will make them. • High speed. An excellent product. Lowest production costs. • Start your post-war production program with the best equipment. Plan for this production now. • We will send complete information — ask us.

HUDSON-SHARP
MACHINE CO • GREEN BAY • WIS

20 mills or 40% stored less than 10,000 tons; 19 mills or 38% from 10,000 to 50,000 tons; 10 mills or 20% from 50,000 to 75,000 tons and 1 mill 150,000 tons.

Tabulated according to fire experience, of the 20 mills having had no fires all but 3 stores less than 20,000 tons. While of the 30 mills having had fires 12 or 40% had coal piles of less than 20,000 tons. Of the remaining 18 mills, 10 belonged to the 50,000 to 75,000 tons group. (Incidentally the mill with the largest pile —150,000 tons—reported trouble with fires.)

Question four covered the length of time during which the coal is stored.

The replies indicated that 20 mills or 40% keep their coal in storage less than one year; 24 or 48% less than 5 years and 4 mills or 8% over 5 years, 2 mills not reporting.

Tabulated according to fire experience, of the 28 mills having had fires 10 had piles less than 1 year old, and 15 from 1 to 2 years. On the other hand 12 mills with no fires had piles up to 4 years old, indicating that no decisive conclusion can be drawn from the age of the pile.

Question five, concerned the means of bringing the coal to the piles. The replies show that 24 mills have their coal brought in by rail, 13 by vessel, 6 by truck and 7 by a combination of vessel and truck or cars.

In reply to question 6, 24 mills replied that they put new coal in a separate pile, while 18 mills put it on top of the old pile Of the remaining 8 mills, one reports that it places the new coal beside the old but makes sure that the line of contact is removed, while one mill stores the new coal in a separate pile if the old is more than 6 months old. One mill finally stores the new coal on top of the old but makes sure that all loose coal around the outside is removed.

Tabulated according to fire experience, there were approximately 40% more fires among the mills mixing the new coal with the old than amongst those having separate piles, indicating the latter as the better practice.

Question 7 inquiring about the equipment used to put the coal in the pile shows that 18 mills used clamshells, 13 mills scrapers, 8 mills trucks, 4 mills self-unloaders while one mill uses a belt conveyor above the pile and one mills drops the coal from cars on a trestle. Five mills do not answer this question.

To question 8 inquiring if when putting coal into the pile the one was left intact or removed, 20 mills reported the cone being left intact while 25 mills state that they removed it. Of the remaining, one mill removed the cone first when taking the coal from the pile; one leaves the cone if the pile is to be used up within 6 months, while 5 mills do not answer this question.

Tabulated according to fire experience, of the mills in the first group, 9 mills had not had fires while 14 had fires. Of those in the second group—cones removed—10 mills had no fires while 14 had fires.

Question 9 covered the height and width of the pile. Of the 48 mills reporting, 8 stored their coal in piles less than 10 ft. high and 50 ft. in width, while 30 mills had piles up to 40 ft. high. Of the remaining mills, one has—or had—a pile 117 ft. high, while two mills had piles up to 600 ft. in width. It does not appear that any definite conclusions can be

Use This MODERN Stuffing Box
The Johnson
Rotary Pressure Joint
Hundreds of paper mills have endorsed it. Write for details.
Product of The Johnson Corporation
848 Wood St., Three Rivers, Mich.

- Self Oiling
- Completely Packless
- Self Adjusting
- Absorbs lateral and angular misalignment
- Lengthens life of syphon drainage pipe.

TRIMBEY MACHINE WORKS
GLENS FALLS N.Y.
PULP SCREENS
WEIGHT AND CONSISTENCY REGULATORS
METERING SYSTEMS FLOAT VALVES

drawn from the height and width of the piles as regards fire prevalence, the number of mills having fires seeming to be fairly evenly distributed with those with not fires.

The nature of the ground on which the coal is stored was covered in question 10. The replies brought out that 5 mills stored their coal on low swampy ground, 13 on high well drained land, 17 on prepared ground and 10 on rough uneven ground. One mill replies that tile drains had been installed underneath the pile, while the coal yard of another mill consists of part concrete slat and part cinder fill.

The experience with fires appears to be rather difficult to explain since of those mills having had fires, 6 had their coal stored on low swampy ground, 6 on high and 13 on prepared ground.

Question 11 covered exposure of the coal pile to prevailing winds. Of the 50 mills reporting, 40 had exposed piles and 8 sheltered. One mill covers the powdered coal part of its pile with waterproof paper, while one has a 6 ft. high concrete wall surrounding and partly sheltering the pile.

Of the 8 mills having sheltered piles, only 3 had had fires, indicating the advantage in protecting the coal against the winds.

Question 12 covered the proximate analysis of the coal in the pile.

Tabulated according to fire experience the figures seem to indicate that high moisture content, high volatile matter as well as high fixed carbon and high sulphur content are inducive to fires.

In question 13 an attempt was made to bring out the most effective methods of preventing fires in the coal pile. The replies were as follows:

4 mills—ventilate the pile
19 mills—impact or pack the coal
12 mills—take temperature readings
No mill—uses chemicals
No mill—uses the dry cap method
3 mills—use other methods
12 mills—do not use any particular method.

Tabulated according to fire experience, however, while the above methods are fairly evenly distributed among the mills having had no fires, 23 of the mills having had fires report using impacting and ventilating methods.

It should be noted in this connection, however, that 10 of these mills state that they have had no or only minor fires since starting impacting.

Of the mills classified as using other methods, one reports using a system of ¾" pipes driven 10 ft. into the pile and connected to a low pressure heater. When heating occurs, water is turned on and the affected part flooded.

This mill comments that a coal company storing large quantities of coal near their property uses a similar method to prevent fires from breaking out and find it very effective.

Of the 50 mills replying to the questionnaire 20 reported no trouble with fires, while 30 had had fires. Commenting on this in question 14 under the heading fire experience, one mill states that it believes the coal company adds chemicals to the coal to prevent fires; one mill storing over 60,000 tons, claims that impacting has completely eliminated earlier serious fire troubles. This mill's method is to spread the coal in 3 ft. layer by means of a dump truck followed by a bull-dozer which further spreads and packs the coal. The pile by this means becomes so hard that the sides of the 40 ft. high pile remain vertical even after coal is being removed.

One mill reports that fires frequently break out when new coal is run into old, one that fires in the pile occur where the coal is loosely piled; while one mill ascribes fires in its pile to low volatile coal and one to high pyrites content.

Question No. 15 covered methods used to extinguish fires already broken out, in reply to which 27 mills report that they remove the affected part of the pile, while 3 mills use water to extinguish the fire.

Replying to the final question, No. 16, of the 30 mills having had fires, 5 mills do not offer any explanation; 5 blame their fires on spontaneous combustion, 7 on segregation of coarse from fine coal, one on mixing different grades in one pile, 2 mills on poorly drained ground and 4 mills on high sulphur content. Other mills ascribe the cause of fires in their piles to the friability of the coal, high wind, high superficial moisture and excessive height of the pile.

Based on the conclusions drawn from the questionnaire together with valuable information supplied by coal company officials, these recommendations may be summarized as follows:

Location of pile—The ground on which the coal is stored should be well rolled, free of coarse rubble and loose materials. Wherever possible, it should be high in relation to surrounding territory and should slope away from the center so as to permit proper drainage. Sub soil drainage is, of course, to be recommended when this can be afforded. Wooden or steel trestles or posts should be avoided.

Nature of Coal—Most bituminous coal offers some fire hazard in storage, some being more susceptible to fires than others. The long held belief of high sulphur coal creating serious fire hazard has now generally been discarded since the lowest sulphur coal frequently has proved poor storing coal. It is, however, likely that pyritic and organic sulphur may accelerate heating thereby contributing to the danger point actually being reached.

The structure of the coal is an important guide to its behavior in storage. Heating being dependent on the rate of oxidation, soft structure coal by breaking down or degrading offers progressively increased oxidating surfaces and therefore, is classed as poor storing coal.

Methods of Storage—Generally speaking fires can be avoided either by admitting air sufficient to prevent the raising of the temperature of the coal or by entirely cutting off the supply of oxygen. The former is practical only in cases where small amounts of coal are stored since to be effective the coal should be packed in thin layers requiring a large area.

One method of effectively excluding the oxygen is to store the pile under water. This, the writer understands, has been done by some large public utilities in the States. The cost of drying the coal before firing must, however, be very expensive.

A variation of complete flooding is the localized flooding by pipes being reported by one mill in the questionnaire. Carried out before the temperature reaches the danger point, this appears to be a cheap as well as effective method.

Packing or impacting the coal is another method by which air is excluded and which has many proponents among the reporting mills, being also highly recommended by the coal producers. For best results, the coal should be put down in layers not over 2-3 ft. thick, each layer being evenly spread out and packed down hard. A bull-dozer preferably used in combination with a sheep's foot tamping roller is recommended for this work, which if correctly done should increase the density of the coal from around 50 up to over 60 lbs. per cubic ft. A substitute for impacting, where this is not feasible, is to remove the fine coal from the cone of the pile and to spread this over the coarse coal on the sides thus filling in the cavities and assisting in excluding the air.

In storing new coal, contact with the coal in the old pile should be avoided since this is often a starting point for fires. This appears to be particularly the case where coals from different mines and of different composition are mixed.

A method commercially called "dry-capping" may also be mentioned as a method of excluding oxygen to the coal in the pile. This consisting in spraying an asphalt emulsion over the surface of the

REDUCE REGISTER COMPLAINTS

If printers and lithographers will use the *Cambridge* Printers' Moisture Indicator to determine the relative humidity of paper and pressroom, they are in position to avoid the most common cause of "off register." This accurate, rugged instrument has the measuring element enclosed in a blade for insertion between hung or stacked sheets. An adjustable index pointer is provided for fixing reference points.

Write for descriptive bulletin.

CAMBRIDGE INSTRUMENT CO., INC.
3701 Grand Central Terminal, New York 17, N. Y.

CAMBRIDGE PRECISION INSTRUMENTS

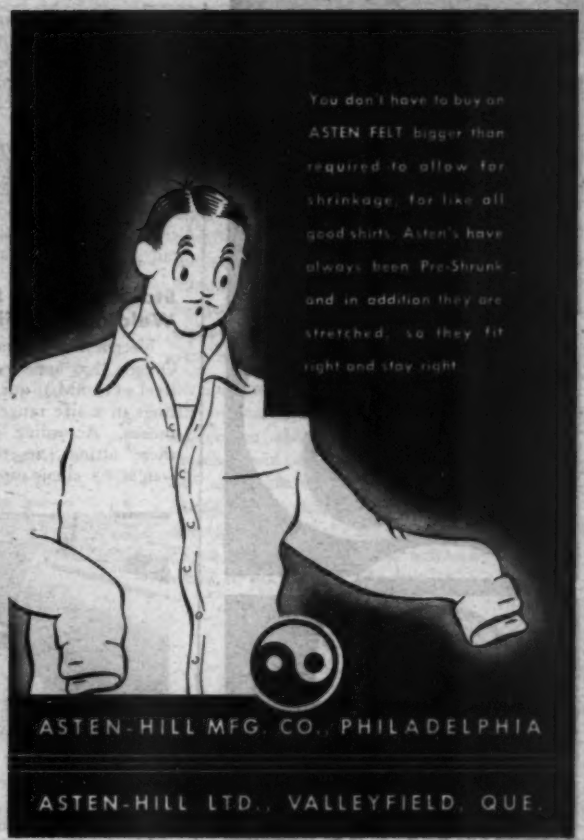
118 years of leadership
SERVING THE PAPER INDUSTRY

Right equipment—a better product at a lower cost. Look to Smith & Winchester's 118 years of leadership for the *right* equipment.

PAPER MAKING MACHINERY
PAPER BAG MACHINES
MODEL "E" UNDERCUT TRIMMER
JORDANS — FOURDRINIERS
WET AND CYLINDER MACHINES
ROTARY SPOT CUTTERS
REELS AND WINDERS
STUFF AND FAN PUMPS
ROLLS OF ALL KINDS

Bulletins furnished on request. We specialize on custom-built machinery to fit your particular needs.

The SMITH & WINCHESTER
Manufacturing Company
SOUTH WINDHAM, CONN.


You don't have to buy an ASTEN FELT bigger than required to allow for shrinkage, for like all good shirts, Asten's have always been Pre-Shrunk and in addition they are stretched, so they fit right and stay right.
ASTEN-HILL MFG. CO., PHILADELPHIA
ASTEN-HILL LTD., VALLEYFIELD, QUE.

pile which when drying forms a hard crust. It is supposed to be very effective when coal is kept in dead storage.

Chemical Treatment—Although perhaps not in general use, chemicals have proved of value in preventing fires. One company, the writer understands, has used a mixture of aluminum sulphate and pulverized calcium carbonate. Added to the coal when loaded in cars at the mine—or perhaps more effective—added to the pile at the mill when the coal is being spread, the carbon dioxide liberated through the chemical reaction between the two chemicals acts as a fire extinguisher.

Another chemical of considerable promise is the use of dry ice. The writer understands that there is a patented method for the use of dry ice in which the latter is charged into a pipe of suitable dimensions driven into the affected part of the pile and having perforations through which the evaporated carbon dioxide escapes into the pile.

◆

Method of Treating Sized Paper Stock

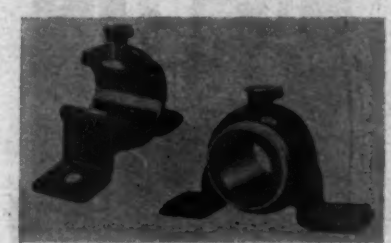
Patent No. 2,366,564. Van L. Shaw, Chicago, Ill. Application August 3, 1940. Serial No. 350,956. 4 Claims. (Cl. 117—103).

4. The process of finishing paper which includes treating the paper stock with a liquid size, then exposing both sides of the web simultaneously to radiant heat in a relatively moist atmosphere and finally moving the web through a dryer.

NEW EQUIPMENT AND SUPPLIES

Self Aligning Bearing For Small Shafts

A self aligning bearing for small shafts, especially adapted for fan and blower service, known as the *Type "F" Bronzoil Bearing*, has been announced by the Dodge Manufacturing Corporation, Mishawaka, Indiana. A bronze capillary bushing is used as a liner. This bushing is surrounded with an oil reservoir which is equipped with close fitting wick and oil cup.



The formed steel base is sprung slightly, when hold-down bolts are tightened, to insure proper pressure between inner and outer housing. The feet of the base are flat and will not collapse under the heaviest pull exerted by hold-down bolts.

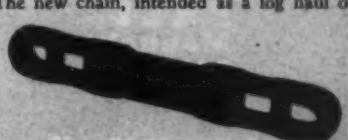
Where desired, Neoprene oil resistant grommets can be provided for isolating sound.

Grease for Ball and Roller Bearing Motors

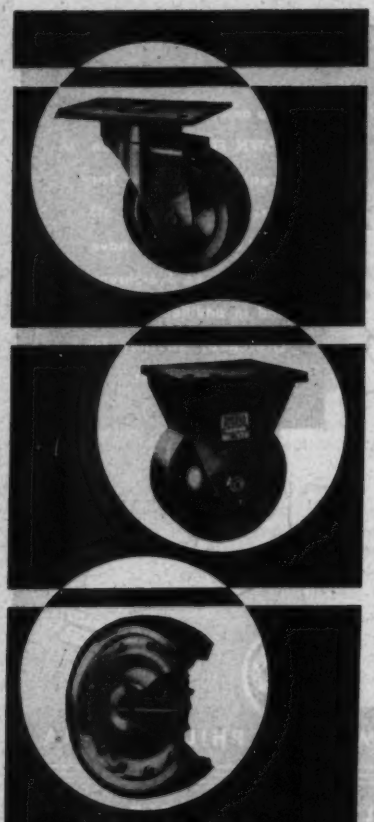
Westinghouse Electric Corporation, 306 Fourth Avenue, Pittsburgh 30, Pa., has announced a grease for ball and roller bearing motors. Available in an eight-ounce, nasal-type tube, the grease, according to the announcement, is stable; highly resistant to oxidation; will remain in a bearing for and indefinite period without drying out, caking or separating; and will furnish dependable lubrication from 13 Fahr. to 176 Fahr. for all speeds up to 3600 rpm and for horizontal or vertical positions.

New Type Log Chain

Chain Belt Company, Milwaukee, Wisconsin, has announced a new type log chain under the designation 8,000 series. The new chain, intended as a log haul or



refuse conveyor chain, is made of cast block links alternated with steel side bar links. The cast links are reinforced with two struts which also serve as anchors for the various attachments. They are built wide to provide a large sliding surface.



DARNELL CASTERS

• Save Money, Floors, Equipment and Time by using DARNELL Casters and Wheels . . . Always dependable,

Wearing Parts Hardened and Carbonized

FREE Manual FOR THE Asking

DARNELL CORP LTD
LONG BEACH 4 CALIFORNIA
60 WALKER ST NEW YORK 13 N.Y.
3A N CLINTON CHICAGO 6 ILL.

Connecting side bars are made of rolled steel, assembled with heat treated rivets. Where greater strength is desired, or where resistance to corrosion is paramount, the center links can be cast of Rex Z-Metal.

The new chain will operate on existing conveyor runways and over the same drums as that of the coil type, although a new driving sprocket is required. The chain will flex smoothly around head and tail sprockets as small as 24 in. diameter.

Stainless Steel Socket-Welding Pipe Fittings

Electric Steel Foundry Co., Portland 10, Oregon, has announced a line of stainless steel (18-8M.) socket-welding pipe fittings in a size range from one inch to 14 inches. According to the manufacturer, these fittings, in the larger sizes, save weight by eliminating flanges and bolts—

also, in many cases, permit the use of lighter gage tubing or fabricated pipe. The fittings likewise lend themselves well to field installation. Because of some services in which the inside of this type of joint presents a corrosion problem, the manufacturer prefers to make all recommendations for its use.

Humidity and Low Temperature Test Cabinet

Northern Laboratories Limited, 3-01 Twenty-Seventh Avenue, Long Island City 2, New York, New York, has announced a controlled humidity and low temperature

test cabinet. The cabinet, designated as Model NL-950 (K), is provided with a self-contained refrigeration system utilizing Freon as the refrigerant. Control is effected by means of two separate potentiometer thermocouple indicating controllers. These controllers are mounted on a standard communications relay rack cabinet.

RODNEY HUNT
ROLLS
STRONGER LONGER LIFE
WOOD
METAL
RUBBER
PLASTIC
PATENTED
"SHAF-TITE"
CONSTRUCTION
RODNEY HUNT MACHINE COMPANY
38 Maple Street, Orange, Mass., U.S.A.

Temperature range of the cabinet is from minus 50 C. to plus 60 C. Humidity conditions, above 3 C. may be held nearly constant at any desired point from 10 per cent to 95 per cent R. H.

The test cabinet is provided with electric test connections, shelf supports, illumination, and a multi-layer window. The lining of the test space is stainless steel as are all parts subject to high humidity conditions. The volume of the test space 12 cu. ft.

pH Meter

A line-operated *p*H meter has been announced by the Macbeth Corporation, 227 West 17th St., New York 11, N. Y. Designated as the new *Macbeth Line-operated*

pH meter, the instrument uses only one control switch in adrition to the electrode switch. *p*H values are read directly on the scale in .1 units over the full range of 0-14 *p*H.

Help your workers to work SAFELY!

Your chief concern about accidents in your company is the suffering they cause your employees and their families.

It's hard to say just how many accidents your company will avoid as the result of a systematized safety effort. This much is certain, however: if you apply the accident-prevention materials and services of the National Safety Council, there will be no question about your saving some of your employees and their families (and your company as well) a lot of grief, unhappiness and misfortune.

Your good safety efforts help protect your workers and your company against working hazards. Thousands of industrial organizations have reduced their accidents 30% to 40% through the adoption of the prescribed, time-tested, result-getting ACCIDENT PREVENTION SERVICE offered by the National Safety Council. A sound Safety Program is a valuable investment for your company . . . invest in Safety NOW!

For Further Information Write:

NATIONAL SAFETY COUNCIL

20 N. Wacker Drive — Chicago 6, Illinois

PAPER and PULP SECTION

To make Council Membership of maximum service, safety administrators of member companies are enrolled in the Industrial Section where their chief interests lie. Safety directors whose companies are engaged in similar operations thus pool their knowledge and experience.

Sectional news letters afford a medium for presenting and exchanging information on specific industrial safety problems and ideas on specific hazards. Section members also cooperate in preparing Safe Practices Pamphlets, Data Sheets, Instruction Cards, etc. The Paper and Pulp Section is extremely active in all Council activities.

UNIVERSAL SAFETY

PERFORATED METAL

Green's

Precision perforations in all sizes for large production and screen durability

Copper • Steel
Monel • Stainless Steel
Chemical Resisting Alloys

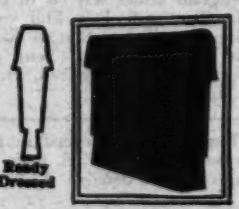
The Harrington & King PERFORATING Co.

5654 Fillmore St., Chicago 44, Ill. 144 Liberty St., New York 6, N.Y.

"READY DRESSED" MILL COGS

LABOR SAVING—TIME SAVING

The Most Economical Filling That Can Be Put in a Mortise Wheel.



Ready Dressed

Blank Head

We Make Any Style or Size Wanted.

Write for Instruction Sheet "O" Which Is Free.

QUICK SERVICE ON ALL SIZES

THE H. P. BOWSHER CO., South Bend, Ind.

POOLE

A COPY OF CATALOG GIVING FULL DESCRIPTION AND ENGINEERING DATA SENT UPON REQUEST.

FLEXIBLE COUPLINGS

POOLE FOUNDRY & MACHINE COMPANY — WOODBERRY, BALTIMORE, MD.

COLEMAN pH ELECTROMETER

Stock Delivery

A limited number of these famous reliable pH electrometers are now available. We suggest ordering immediately.

Used in hundreds of mills for control of pH of whitewater, beater operation and more recently in manufacture of weather-proof containers, using Casco Resin No. 18, with starch.

Guarantees uniformity of sheet, perfect printing surface, strengthens folding quality.

Single scale, 0-13 pH by O-1 pH divisions. Complete with Sealed Ag-Ag Cl Glass and Reference Electrodes, buffer solution, tubes, batteries. Price $180.00.

Write for Catalog PI-246

Wilkens-Anderson Co., 111 N. Canal St., Chicago 6, Ill.

CHEMIPULP PROCESS INC.

CHEMICAL PULP MILL ENGINEERS

500 Woolworth Building, Watertown, N. Y. — 3311 First Avenue South, Seattle, Wash.

Associated with CHEMIPULP PROCESS LIMITED, Montreal, Que.

MISCO "C"

THE CORROSION RESISTANT ALLOY

CAST • ROLLED • FABRICATED

for all equipment exposed to corrosion by sulphite acids

MICHIGAN STEEL CASTING CO., DETROIT 7, MICH.

Take A Look . . .

8 Publications for the Papermaker

Modern Pulp and Paper Making $6.75
G. S. Witham, Sr.
Second Edition, Revised and Enlarged. A book of 704 pages, written for machine tenders, beater men, and other practical mill workers, as well as for engineers, technologists and executives.

Trouble on the Paper Machine ..... .75
Archie McCaffery
A monograph—published in convenient pocket-sized edition. Bulk rates, in groups of ten or more, 50 cents per copy.

Pulp Bleaching (A Symposium) ..... .50

Technology of Papermaking Fibers ..... .50

Lessons in Paper Making—Part 1 ..... .50
Harry Williamson

Lessons in Paper Making—Part 2 ..... .50
Harry Williamson

Drying of Paper on the Machine 1.50
B. M. Baxter

Procedure Handbook of Arc Welding Design and Practice 1.50
Seventh Edition—latest information on all phases of arc welding—1308 pages—1810 illustrations. Standard text in hundreds of schools and colleges. ($2.00 outside U.S.)

Now available postpaid from

FRITZ PUBLICATIONS, INC.

59 E. Van Buren St., CHICAGO 5, ILL.

GEORGE F. HARDY

Consulting Engineer to the Paper Industry since 1900

441 Lexington Avenue, New York 17, N. Y.

Member—Am. Soc. C. E.—Am. Soc. M. E.—Eng. Inst. Can.

Consultation	Paper and Pulp Mills
Reports	Hydro-Electric and
Valuations	Steam Power Plants
Estimates	Plans and Specifications

CARTHAGE MACHINE CO.

• • •

CARTHAGE, NEW YORK

Machinery for Ground Wood and Chemical Pulp Mills.

CONFIDENTIAL
EMPLOYMENT SERVICE
FOR PAPER AND PULP MILLS
WE INVITE CORRESPONDENCE (Confidential) WITH EMPLOYERS SEEKING EXECUTIVES AND EXECUTIVES SEEKING NEW POSITIONS
CHARLES P. RAYMOND SERVICE, INC.
PAPER MILL DEPARTMENT
294 WASHINGTON STREET BOSTON 8, MASS.

CALCUTTA, INDIA

A well-established firm with long experience desires exclusive representation of the manufacturers and shippers of papers, newsprint and paperboards, fibreboards, etc., for Calcutta. Kindly communicate with S. N. JHUNJHUNWALLA, 92, Harrison Road, Calcutta, India.

Man of 12 years paperboard manufacture and 5 years of industrial selling experience (part time), desires selling position with some papermaking or chemical (paper) concern. 30 years of age, good education, intelligent, personable and ambitious. Married. Address Box 404, Fritz Publications, Inc.

WANTED—Long established, nation-wide organization with extensive expansion program under way, is in need of an experienced Tour Boss familiar with Felt Mill operations, to be trained for Assistant Superintendent job at its New Orleans plant. Exceptional opportunity for right man. Send complete resume giving experience, education, salary desired, etc. Address Box 409, Fritz Publications, Inc.

WANTED—Sales Engineer, experienced in paper mill work, for selling well-known pump line to U. S. mills. Must be willing to travel. Write giving complete details. Address Box 410, Fritz Publications, Inc.

WANTED—Assistant Superintendent or Tour Boss position, roofing felts, boxboards or kraft. Would consider good job running machine. Address Box 411, Fritz Publications, Inc.

Index to Advertisers

When writing them, please mention The Paper Industry and Paper World

Refer to the Paper and Pulp Mill Catalogue and Engineering Handbook at your mill office, for complete listing of all advertisers' products.

Allis-Chalmers Mfg. Co. 1634-1635
American Car & Foundry Co. 1661
American Cyanamid & Chemical Corporation 1629
American Hoist & Derrick Co. 1656
American Lumber & Treating Co. 1676
American Paper Machinery & Engr. Works, Inc. 1676
American Resinous Chemicals Corp.
Appleton Machine Co., The 1606
Appleton Wire Works, Inc. 1628
Appleton Woolen Mills 1673
Armour and Company 1721
Armstrong Machine Works 1676
Asten-Hill Mfg. Co. 1721
Atkins and Company, E. C. 1676
Aurand Mfg. & Equipment Co.
Aurora Pump Company
Automatic Transportation Co.

Bagley & Sewall Co., The
Bailey Meter Company
Baldwin-Duckworth Div. of Chain Belt Company 1674
Bauer Bros. Co., The 1659
Becco Sales Corporation 1605
Beloit Iron Works 1595
Binney & Smith Co. 1670
Bird Machine Company
Bird-White Company 1636
Black-Clawson Co., The 1672
Boston Woven Hose & Rubber Co.
Bowser, Incorporated
Bowsher Co., The N. P. 1723
Brown Instrument Co., The
Buffalo Forge Company
Buffalo Pumps, Inc.

Calco Chemical Division, American Cyanamid Company 1633
Cambridge Instrument Co. 1720
Cameron Machine Co. 1717
Carthage Machine Co. 1724
Cash Company, A. W.
Chain Belt Company 1674
Chemipulp Process, Inc. 1724
Chicago Bridge & Iron Co. 1678
Chicago Electric Company 1718
Chromium Corp. of America
Clark Tructractor Division of Clark Equipment Company
Classified Advertising 1724
Clayton Manufacturing Co.
Cleveland Tramrail Div., The Cleveland Crane & Engineering Co. 1669
Cochrane Corporation
Columbia Chemical Division 1655
Columbian Carbon Company
Cooper Alloy Foundry Co., The 1623
Crane Co. 1668

Darnell Corporation, Ltd. 1722
Davis and Thompson Co. 1716
De Laval Steam Turbine Co. 1638
DeZurik Shower Company 1707
Diamond Alkali Company 1615
Dilts Machine Works 1672
Dodge Manufacturing Corporation 1596
Dow Chemical Co., The 1607
Downingtown Mfg. Co. ..... 4th Cover
Draper Brothers Company 1632
Dresser Industries, Inc. 1703
du Pont de Nemours & Co., E. I.
Duriron Co., Inc., The

Eastern Stainless Steel Corp. 1649
Eastwood-Nealley Corporation 1714
Economy Co., Inc. 1715
Electric Machinery Mfg. Co.
Electric Steel Foundry
Elwell-Parker Electric Co., The 1601
English China Clays Sales Corp. 1710

Fairbanks, Morse & Co. 1622
Falk Corporation, The
Falls Chemical Products Co.
Ferguson & Co., Hardy S. 1656
Fitchburg Screen Plate Co., Inc.
Fleishel Lumber Company 1706
Flexible Steel Lacing Co. 1636
Fiori Pipe Company 1631
Foxboro Company, The
Fritz Publications, Inc. 1724, 1726

Garlock Packing Co., The
Gates Rubber Company 1624
General American Transportation Corporation 1604
General Chemical Company 1602
General Electric Company
Glidden Company, The
Goslin-Birmingham Mfg. Co., Inc. 1600
Goulds Pumps, Inc.
Graver Tank & Mfg. Co., Inc. 1636
Groch Engineering Co.
Gruendler Crusher & Pulverizer Co.

Hammermill Paper Co.
Hanchett Manufacturing Co. 1705
Hardy, George F. 1724
Harper Company, The H. M. 1659
Harrington & King Perforating Co. 1723
Harris-Seybold-Potter Co. ..... 2nd Cover
Hermann Mfg. Co., The 1701
Hooper & Sons Co., Wm. E. 1677
Hudson-Sharp Machine Company 1719
Hunt Machine Co., Rodney 1722
Huyck & Sons, F. C. 1618
Hyster Company

Improved Paper Machinery Corp.
Industrial Steels, Inc.
Ingersoll-Rand Company 1637
Ingersoll Steel & Disc Div., Borg-Warner Corporation
International Nickel Co., Inc. 1667

Jeffrey Mfg. Co., The 1621
Jenkins Bros. 1611
Johnson Corporation, The 1719
Jones & Sons Company, E. D. 1619
Jones Foundry & Machine Co., W. A.

Kalamazoo Tank & Silo Co. 1719
Kalamazoo Vegetable Parchment Co.
Kelco Company 1651
Kohler System Co., The
Koppers Company, Inc., Bartlett-Hayward Division 1598

Langston Co., Samuel M. ..... 3rd Cover
Layne & Bowler, Inc. 1704
Lewellen Manufacturing Co.
Lindsay Wire Weaving Co., The 1676
Link-Belt Company 1665
Lockport Felt Company 1702
Lodding Engineering Corp. 1612
Lunkenheimer Co., The 1698

Magnetic Pigment Division, Columbian Carbon Company 1670
Magnus Chemical Co., Inc.
Marion Machine, Foundry & Supply Company
Mason-Neilan Regulator Co. 1654
Mathieson Alkali Works, Inc.
Michigan Steel Casting Co. 1724
Midwest Piping & Supply Co., Inc. 1618
Monsanto Chemical Company 1639
Morey Paper Mill Supply Co. 1610
Mt. Vernon-Woodberry Mills, Inc.
Murray Mfg. Co., D. J. 1701

Nash Engineering Co., The 1670
National Bearing Division, American Brake Shoe Co.
National Oil Products Co. 1660
National Publishers Ass'n, Inc.
National Research Bureau, Inc.
National Safety Council, Inc. 1723
Naylor Pipe Company
Nichols Engr. & Research Corp. 1710
Norma-Hoffmann Bearings Corp. 1701
Northern Engineering Works 1641
Norton Company
Norwood Engineering Co., The 1713

Oakite Products, Inc. 1656
Ohio Injector Co., The
Oilgear Company, The
Oliver United Filters, Inc.
Orr Felt & Blanket Co., The 1711
Orton Crane & Shovel Co. 1609

Paper & Industrial Appliances, Inc. 1626
Paper Makers Chemical Dept. of Hercules Powder Company
Patterson Foundry & Mach. Co. ..... 1st Cover
Peerless Pump Div., Food Machinery Corporation
Perkins & Son, Inc., B. F. 1640
Permutit Company, The
Philco Corporation 1647
Pittsburgh Piping & Equipment Co.
Pittsburgh Plate Glass Co., Columbia Chemical Division 1656
Poole Foundry & Machine Co. 1723
Powell Company, The Wm. 1652
Pusey & Jones Corp., The 1645

Railway Supply & Mfg. Co., The 1724
Raymond Service, Inc., Charles P. 1620
Reichhold Chemicals, Inc. 1613
Reliance Electric & Engr. Co. 1613
Research Corporation
Rodgers Hydraulic, Inc.
Rogers & Co., Samuel C.
Roofing Machinery Mfg. Co. 1712
Roots-Connersville Blower Corp. 1703
Ross Engineering Corp., J. O.
Ryerson & Son, Inc., Joseph T. 1715

Sandusky Foundry & Machine Co.
Sandy Hill Iron & Brass Works, The 1675
Shartle Bros. Machine Co. 1672
Shuler & Benninghofen 1650
Smith & Winchester Mfg. Co. 1721
Solvay Sales Corporation
Spraying Systems Company 1670
Standard Oil Co. (Indiana) 1617
Stebbins Engr. & Mfg. Co. 1708
Stein, Hall & Company, Inc. 1686
Stickle Steam Specialties Co.
Sutherland Refiner Corporation 1603
Swenson Evaporator Company 1614

Taylor Forge & Pipe Works 1658
Texas Company, The 1597
Thomas Flexible Coupling Co. 1630
Timken Roller Bearing Co., The 1608
Titanium Pigment Corporation
Torrington Co., Bantam Bearings Division 1671
Towmotor Corporation
Trimbey Machine Works 1719
Turner Halsey Company

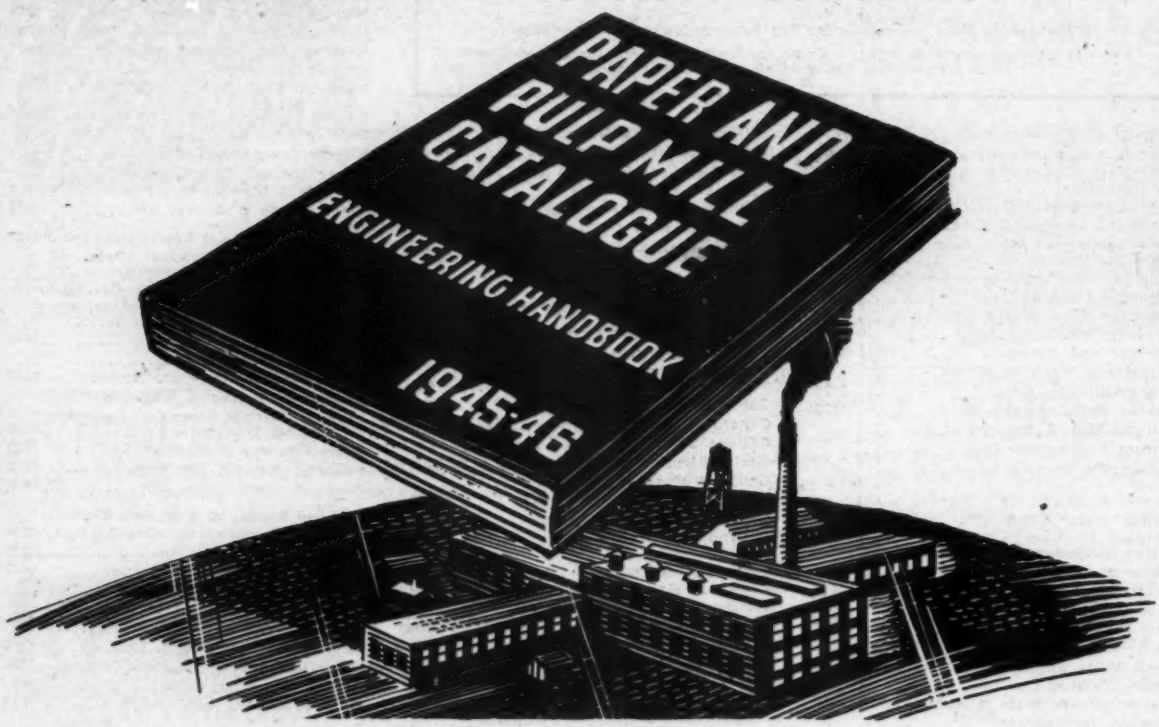
U. S. A., Treasury Dept.
Union Pacific Railroad Co. 1653
United States Rubber Company
U. S. Stoneware Co.

Valley Iron Works Company
Vanderbilt Co., Inc., R. T. 1642

Waldron Corporation, John 1657
Warren Steam Pump Co., Inc. 1709
Waterbury & Sons Co., H. 1656
Waterbury Felt Co., The
Western Precipitation Corp.
Westinghouse Electric Corporation
Weyerhaeuser Timber Co. 1627
Whiting Corporation 1614
Whittaker, Clark & Daniels, Inc. 1625
Wilkens-Anderson Company 1724
Williams and Co., C. K. 1676
Williams-Gray Company
Worthington Pump & Machinery Corporation
Wyandotte Chemicals Corporation

Youngstown Welding & Engineering Company, The

Now available at your mill office . . .



ready to serve in the maintenance and operation of your mill. A larger CATALOGUE SECTION with detailed information about the products of the prominent manufacturers that supply the industry. The cross-indexed BUYERS SERVICE SECTION to help you locate sources of purchases for machinery, equipment, chemicals and supplies. The ENGINEERS HANDBOOK extended for your use through the addition of a number of charts and tables.

The PAPER AND PULP MILL CATALOGUE has been edited and produced to serve you. Use it frequently—the more you refer to it, the more helpful it will be to you.

These firms describe their products in the 1945-46 edition—

Allington & Curtis Mfg. Co., The
Allis-Chalmers Mfg. Company
American Cyanamid & Chemical Corporation
American Deaerator, Inc.
American Paper Mach'y. & Engr. Works, Inc.
Appleton Machine Co., The
Armour & Company
Armstrong Machine Works
Atkins & Company, E. C.
Aurora Pump Co.
Automatic Transportation Company
Bagley & Sewall Company, The
Bauer Bros. Company, The
Beloit Iron Works
Benjamin Electric Mfg. Co.
Bigge Boiler Works Company, The
Bird Machine Company
Black-Clawson Co., The
Blaw-Knox Division (Blaw-Knox Company)
Blickman, Inc., S.
Bowser, Incorporated
Buffalo Forge Company
Buffalo Pumps, Inc.
Buflovak Equipment Division (Blaw-Knox Company)
Cameron Machine Company
Carthage Machine Company
Cash Company, A. W.
Chemipulp Process, Inc.
Chicago Bridge & Iron Company
Chicago Electric Company
Clark-Aiken Company, The
Control Equipment Corporation
Covel-Hanchett Company
DeZurik Shower Company
Dilts Machine Works
Dow Chemical Company, The
Downingtown Manufacturing Co.
Dresser Industries, Inc.
Duriron Company, Inc., The
English China Clays Sales Corporation
Falk Corporation, The
Farrel-Birmingham Company, Inc.
Fitchburg Screen Plate Company, Inc.
Fleishel Lumber Company
Foster Wheeler Corporation
Fuller Brush Company
Garlock Packing Company, The
General American Transportation Corporation
Glens Falls Machine Works, Inc.
Glidden Company, The
Golden-Anderson Valve Specialty Company
Goslin-Birmingham Manufacturing Co., Inc.
Graver Tank & Mfg. Co., Inc.
Gruendler Crusher & Pulverizer Co.
Harper Company, The H. M.,
Harris-Seybold-Potter Co.
Hauser-Stander Tank Co.
Hercules Powder Company, Inc.
Hermann Manufacturing Co., The
Hewitt Machine Company, Inc., J. W.
Hills-McCanna Co.
Holyoke Machine Company
Hooker Electrochemical Company
Improved Paper Machinery Corporation
Industrial Gear Mfg. Co.
Infilco Inc.
James Manufacturing Co., D. O.
Jeffrey Manufacturing Co., The
Johns-Manville
Johnson & Carlson
Johnson Corporation, The
Jones & Sons Company, E. D.
Jones Foundry & Machine Co., W. A.
Kalamazoo Tank & Silo Company
Kohler System Company, The
Lancaster Iron Works, Inc.
Langston Company, Samuel M.
Lawrence Machine & Pump Corporation
Leader Iron Works, Inc.
Link-Belt Company
Lovejoy Flexible Coupling Co.
Market Forge Company
Mason-Neilan Regulator Co.
Maxson Automatic Machinery Company
Meisel Press Manufacturing Company
Merrick Scale Mfg. Co.
Michigan Pipe Company
Monsanto Chemical Company
Morris Machine Works
Moyno Pump Div., Robbins & Myers, Inc.
Murray Manufacturing Co., D. J.
National Aluminate Corporation
National Casein Sales
Naylor Pipe Company
Nekoosa Foundry & Machine Works, Inc.
Nichols Engineering & Research Corp.
Noble & Wood Machine Co., The
Norma-Hoffmann Bearings Corporation
Northern Engineering Works
Norwood Engineering Company, The
Ohio Grease Company, The
Oliver United Filters, Inc.
Paper & Industrial Appliances, Inc.
Paper Makers Chemical Departmnt (Hercules Powder Co., Inc.)
Pennsylvania Salt Manufacturing Co.
Perkins & Son, Inc., B. F.
Pittsburgh Piping & Equipment Co.
Porter Company, Inc., H. K.
Pusey & Jones Corporation, The
Record Foundry & Machine Company
Reichhold Chemicals, Inc.
Robbins & Myers, Inc.
Rollway Bearing Company, Inc.
Roots-Connersville Blower Corp.
Ross Engineering Corporation, J. O.
Sandusky Foundry & Machine Co.
Sandy Hill Iron & Brass Works, The
Schutte & Koerting Company
Seybold Division, Harris-Seybold-Potter Co.
Shartle Bros. Machine Co.
Simonds Worden White Co.
Simpson Company, The Orville
Sinclair Company, The
Solvay Sales Corporation
Stainless Steel Division, Pittsburgh Piping & Equipment Co.
Stebbins Engineering & Manufacturing Company
Stein-Hall
Sullivan Machinery Company
Swenson Evaporator Company
Taylor Forge & Pipe Company
Toledo Scale Company
Trimbey Machine Works
Tube Turns, Inc.
Twin Disc Clutch Company
Union Machine Company
Union Screen Plate Co.
Valley Iron Works Company
Waldron Corporation, John
Wallace & Tiernan Co., Inc.
Warren Steam Pump Company, Inc.
Westinghouse Electric Corporation
Whiting Corporation

Please mention the PAPER AND PULP MILL CATALOGUE when making inquiries.

FRITZ PUBLICATIONS, Inc. 59 East Van Buren Street CHICAGO, ILLINOIS

Successful combinations

As a smooth-working team, the fife & drum have long been familiar symbols in our country's history. Another successful combination is the use of Langston's Type "AA" Slitter by The Texas Company in the preparation of saturated asbestos felt for distribution in connection with special uses.

All Langston Slitters and Roll Winders are heavily constructed with balanced drums and idlers to prevent vibration. Bearings, gears and all parts are proportioned to assure maximum service. Noted for exceptional performance with low maintenance costs, Langston Slitters will meet every need in Mill, Finishing Room or Converting Plant.

SAMUEL M. LANGSTON COMPANY, CAMDEN, N. J.

Langston

SLITTERS AND ROLL WINDERS

TEXACO

DOWNINGTOWN

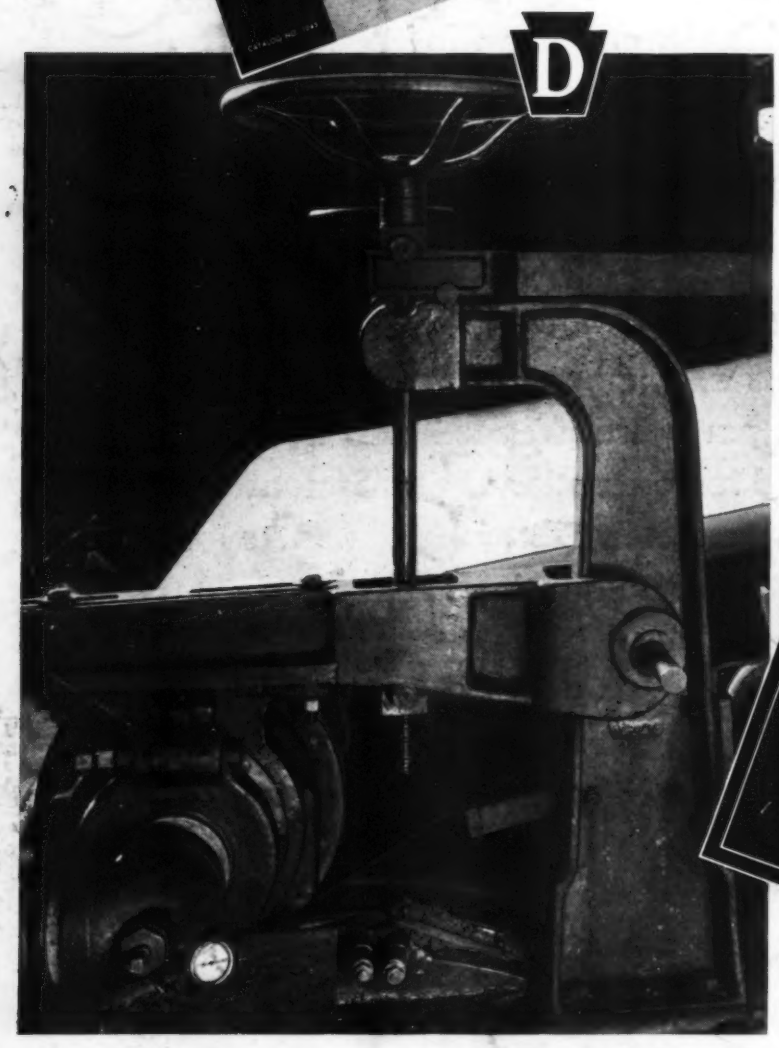
Designers & Builders
Paper Making Machinery

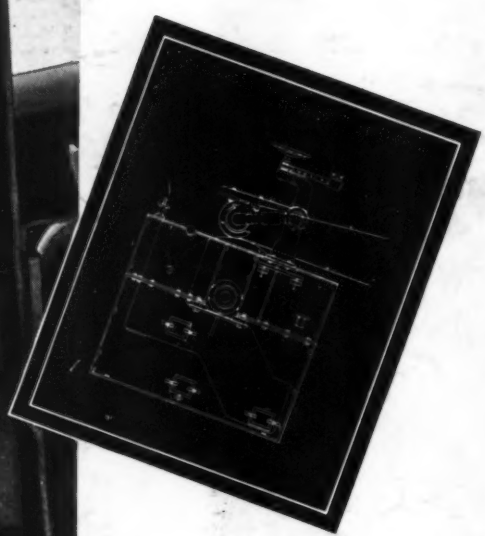
Proved "Before" and "During" the War—
Improved "Since"

Photograph and line drawing show a pre-war pioneering installation of the Downingtown Suction Cylinder Couch Roll on a flooring felt machine.

Drawing on cover of our new Bulletin No. 1045 shows the new design. This roll does its couching by air pressure. Applicable to single or multi-cylinder machines. Send for Bulletin No. 1045.

DOWNINGTOWN MFG. CO.
DOWNINGTOWN, PA.





N